3

TWENTY-SECOND YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

Vol. XXIII—No. I. OTTAWA, JANUARY 31st, 1904. Vol. XXIII—No. I.

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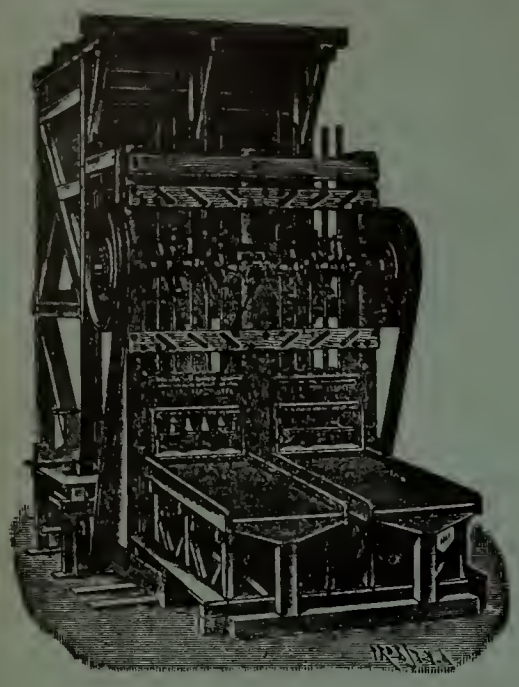

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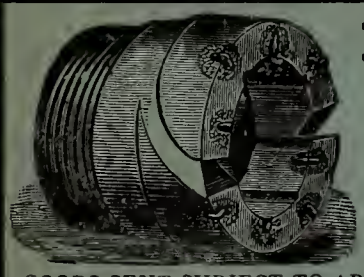

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TWENTY-FIRST YEAR OF PUBLICATION

The Canadian Mining Review

Established 1882

An Illustrated Monthly Journal of Information for Mine Managers and Mining Engineers.

THE OLDEST AND ONLY OFFICIAL AND ENGINEERING JOURNAL PUBLISHED IN THE DOMINION OF CANADA.

EDITED AND PUBLISHED BY

B. T. A. BELL

Royal Commissioner on Yukon Hydraulic Concessions
Secretary of The Canadian Mining Institute
Secretary of The General Mining Association of Quebec
Secretary of The Ontario Mining Protective Association
Secretary Canadian Mica Miners' Association

1903

Volume XXII.

Editorial Offices:—ORME'S HALL, OTTAWA, CANADA.

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CANADIAN MINING INSTITUTE

ANNUAL MEETINGS

The Annual General Meetings of the members of the Canadian Mining Institute for the transaction of business, the discussion of papers, etc., will be held in the

KING EDWARD HOTEL, TORONTO

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..... 2nd, 3rd and 4th MARCH, 1904 .....

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INSTITUTE GOLD MEDAL.

The Council of the Institute will award a Gold Medal for the best paper contribnted by members to the Transactions of the Institute during the year 1904.

STUDENTS' PRIZES.

In addition to the President's Gold Medal the Council offers three prizes of a cash value of twenty-five dollars each for the best papers contributed by Canadian mining students on the following subjects :—

GROUP I.—ORE DEPOSITS AND MINING GEOLOGY—The subject may be treated generally, or some particular district or single deposit may be discussed or described.

GROUP II.—MINING PRACTICE—Any and every branch of mining may be treated such as pumping, hoisting, ventilation, timbering, ore extraction, development, etc., etc., or some particular method of mining, or some individual mine or group of mines, may be described or discussed.

GROUP III.—ORE DRESSING AND METALLURGY—Any branch of ore dressing or metallurgy may be treated as for example—crushing, jigging, milling, concentrating, smelting, roasting, cyaniding, etc., or some particular plant may be described or discussed.

Competitors must advise the titles of their subjects to the Secretary of the Institute not later than the 18th February next and MSS. must be sent to him on or before the opening session of the meeting on 2nd March.

SYLLABUS OF PAPERS.

Syllabus, embracing over forty papers, and detailed programme of arrangements for these meetings will be mailed to members in due course.

EUGENE COSTE,
PRESIDENT.

B. T. A. BELL,
SECRETARY.

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THE REVIEW PUBLISHING CO., LIMITED,

P. O. Box 2187, Montreal, Canada.

1904

VOLUME XXIII.

157 ST. JAMES STREET, MONTREAL.

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*Articles marked with an asterisk are illustrated.

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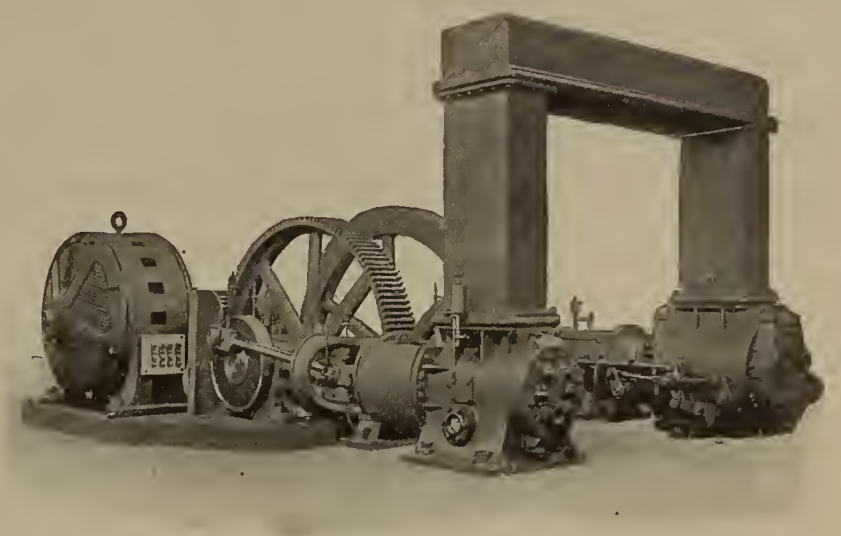

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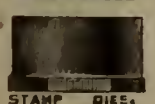

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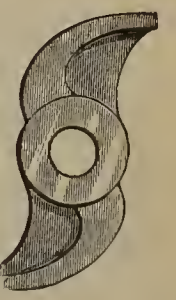

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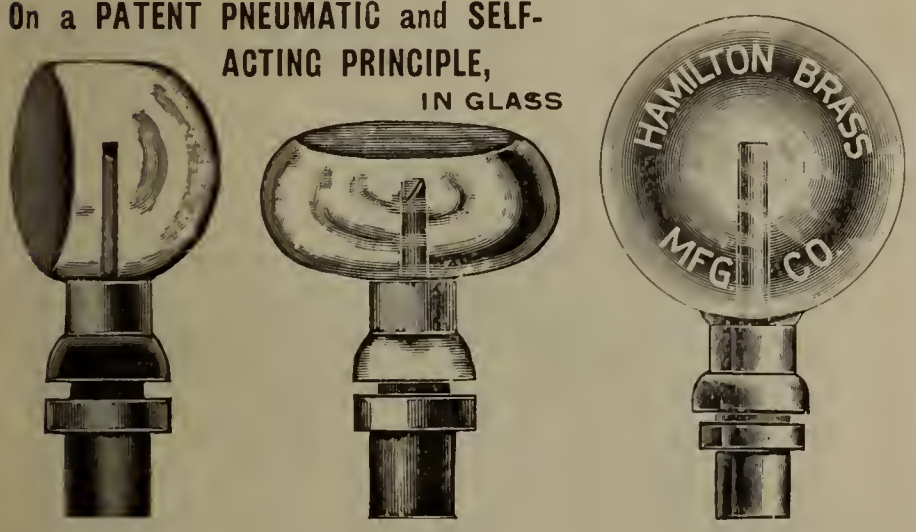

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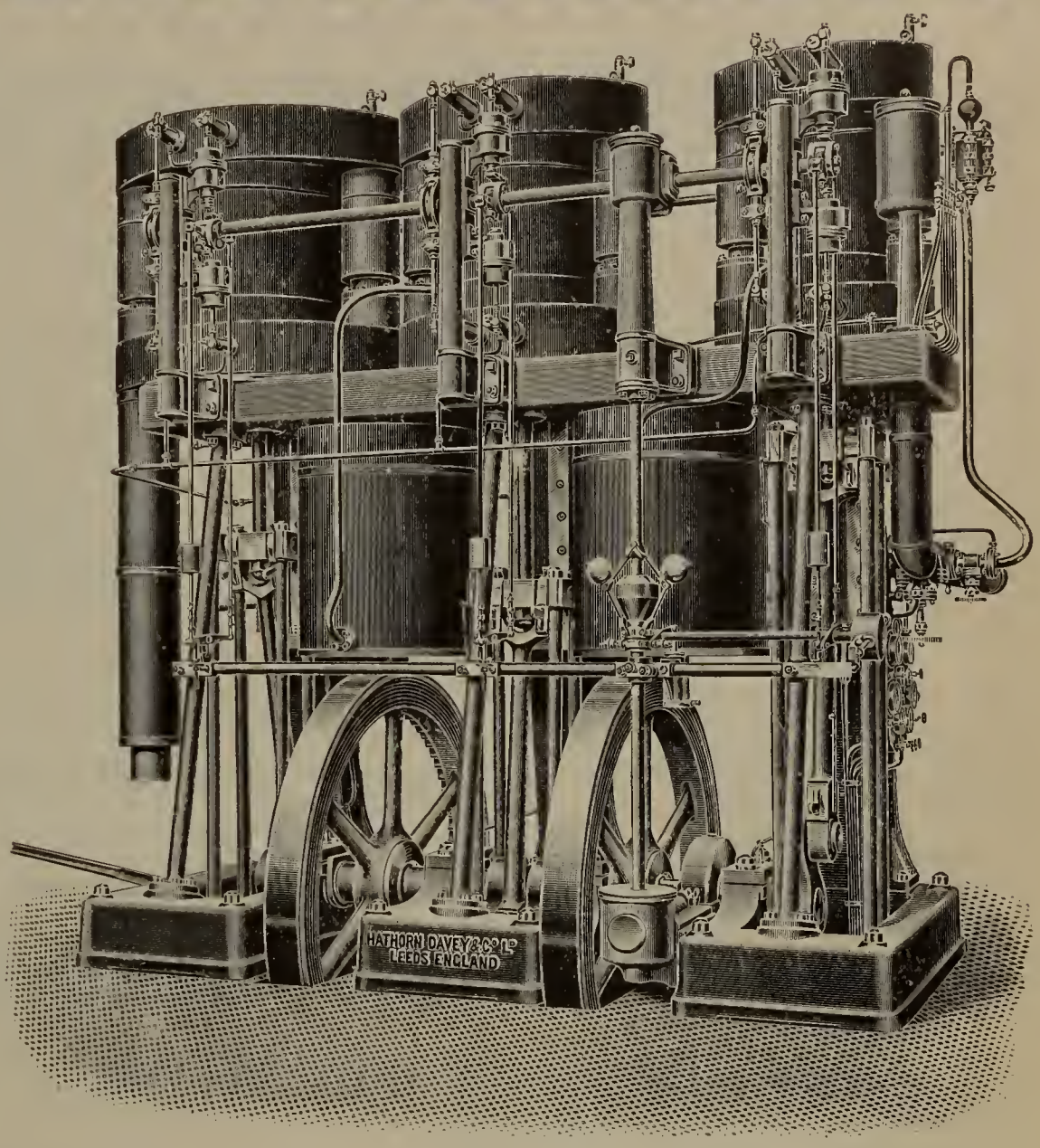

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22nd YEAR OF PUBLICATION

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B. T. A. BELL, Editor and Proprietor.
Secretary, Canadian Mining Institute, etc.

Published Monthly.

OFFICES { Orme's Building, Ottawa; Windsor Hotel, Montreal.

VOL. XXIII., No. 1. JANUARY, 1904. VOL. XXIII., No. 1.

The Coal Trade in 1903.

Now that the full details are to hand, showing the output of coal and coke in the Dominion during 1903, we are able to note the satisfactory development of an industry, which is the basis of nearly all our manufactures. It is only necessary to state here that the total output of coal in the Dominion will reach 7,500,000 tons, an increase over 1902 of 1,000,000 tons. According to the most reliable estimates the price at the pit-mouth will be approximately 25 cents less than the previous year and as wages are about 10% higher, it is obvious that the margin of profit must be somewhat less, probably 35 cents.

The greatest development during the year has been in the Maritime Provinces to which the capital has been attracted by the prominence given to the operations of the Dominion Coal Company. The latter has been unfortunate in several respects, the principal one being the fire in Dominion No. 1, which reduced the output of that mine for the year at least five hundred thousand tons, and effectually discounted the increase in the other mines. The fire broke out in March, and in spite of the positive assertions made at time that in two or three months it would be extinguished and the mine producing as large a tonnage as ever, we find during the month of December, after the lapse of nearly ten months, that the output is only 18,936 tons, or about one-fourth of the normal capacity of the mine. A recognized expert who is familiar with the conditions, immediately after the fire broke out said it would take at least a year to repair the damage and would involve the loss of one million dollars. This information was given in our columns, and it is now certain that the estimate was a conservative one, as in the lower levels, which were flooded, the water still remains, and it is doubtful whether it will be all pumped out for many months to come. The principal offset of this disaster is the development of Dominion No. 2, which bids fair to be a large producer, but there is reason to believe that the present management will not attempt to realize the intentions of those who designed this enormous mine in the expectation of the output ranging from 5,000 to 10,000 tons per day. The enormous cost of equipment, which already stands at more than $2,500,000, compared with the comparatively moderate results achieved, has no doubt served to convince the company's present advisers that an increased number of smaller mines is preferable to one of such gigantic proportions, where a single catastrophe might lay the whole idle, and have a serious effect upon the fortunes of the company. It has also been clearly demonstrated that coal cannot be produced as cheaply in a mine of this extent as in one of more moderate output, ranging from 2,000 to 3,000 tons a day.

The most notable feature in the coal industry of the Maritime Provinces is the very large increase in the production of the Nova Scotia Steel and Coal Company. Under the enterprising management of Mr. Graham Fraser, and his confreres, old Sydney Mine has indeed taken on a new lease of life, and the ontput of 480,000 tons, must be gratifying to the company. Incidentally we may remark that the Dominion Iron and Steel Company is to be highly congratulated on securing the services of Mr. Fraser, who is beyond peradventure the strongest and the most practical man in his line in the Dominion, and if the tide of success, which has attended his efforts during the last twenty-five years in building up the magnificent reputation of the Nova Scotia Steel and Coal Company attends him in his new venture the result will go far to counteract the regime of mismanagement and incompetency which has preceded him. In a quiet way, and without much blowing of trumpets, the Inverness Railway and Coal Co., at Broad Cove, has made splendid progress, and obtained an output of 1,000 tons a day. We have always expected this property to develop into one of the most important coal producers on the Island of Cape Breton, and if it had fallen into the more competent hands, which are now guiding its destinies, instead of having been exploited ten years ago by our volatile friend Penn Hussey, it would long ago have established a record, and we have no doubt that in the next five years it will be one of the largest and most profitable concerns in the trade. The coal areas in Mabou and Port Hood are slowly but surely developing and the same may be said of those at Port Morien, although the latter are moving somewhat slower owing to engineering difficulties. If the operations were conducted from South Head instead of from the Mainland this mine would become a large and successful mining proposition. With a total output of 5,000,000 tons for the year, the old mining district of the Maritime Provinces has done well, and the increase is only a faint earnest of what may be expected in the near future. Conditions for 1904 are in some respects not as favourable as last year notably in the decrease of American demand and the fall in selling prices. Now that the demand in the United States has fallen off so greatly it will be difficult for Canadian coal to find a market until trade improves. It is probable that the exports will fall at least five hundred thousand tons this year. The St. Lawrence will pay less for coal, and contracts will shortly be concluded at a reduction ranging from 25 to 50 cents per ton; the outlook therefore calls for rigid economy in production, and we believe that producers will be well advised if they call a halt in development, except such as is necessary to maintain the mine in an efficient condition, and content themselves with the profit to be realized upon a more moderate output. Any attempt to

force production in 1904 and 1905 will only result in increased competition and diminishing profits.

In British Columbia the year has been the most prosperous on record. The Coast mines, in the agregate, are still the largest producers, having attained an output of 1,200,000 tons. At the end of the year conditions were very much more favourable than at the beginning. The somewhat pessimistic views expressed as to the effect of fuel oil upon the coal trade have not been realized and it looks as if the industries of the Pacific Coast are on the threshold of a development which will surpass all expectations. At the present time the demand for coal is far greater than the supply, and the Western Fuel Company which purchased the mines of the New Vancouver Coal Mining and Land Company have realized handsome profits in the first year.

The greatest increase, however, stands to the credit of the Crows Nest Pass Coal Company, which has an output of coal for the year of 661,118 tons, an increase over the previous year of 219,882 tons, or 50 per cent. But for the unfortunate srike, which closed their mines for two months, the output would have been about seven hundred and fifty thousand tons. It is satisfactory to know that the output of coke shows an increase of 39 per cent, having reached the respectable figure of 167,734 tons. There are now in operation nearly 1,000 ovens, which, with those under construction, will raise the total number to 1,200, having a capacity of nearly 2,000 tons of coke per day; there is no reason why British Columbia smelters should have to complain about lack of fuel supply especially as the tonnage will be largely increased during the coming year. A reasonable estimate for 1904 will be one million tons of coal and two hundred and fifty thousand tons of coke.

The most striking feature of the coal trade in British Columbia and the adjoining areas in Alberta is the large number of Companies which have commenced operations during 1903 and the still larger number which are being organized for the present year. The most extensive of these consist of a series of five mining properties consolidated under the control of a French Syndicate of which Mr. J. Fleutot is the managing director. This group is situated from 10 to 15 miles east of the Crows Nest summit in the neighbourhood of Blairmore. At present the output is 600 tons daily, the whole of which is taken by the C.P.R. for steam purposes. The International Coal and Coke Co., is opening up a mine three miles west of Blairmore, from which they purpose supplying the fuel required for the Granby Smelter. In addition the C.P.R. have commenced to operate a coal property on the north branch of Michel Creek and three companies are being formed to develope the enormous areas on the Elk River, where the extension of the Fernie seams has been discovered. It is altogether likely that by the end of the present year the output of coal in this district will be doubled as there is an unlimited market both in British Columbia, the Territories, and over the line in Montana, there is no reason why for some years to come handsome profits should not be realized and satisfactory dividends earned.

It is also a matter of interest to note that extensive deposits have been discovered by the C.P.R. in the Cascade Mountains near to Banff and development is proceeding at a great pace as in view of the rapidly diminishing output from the Canmore and Anthracite mines a supply of steam coal is a matter of great importance. The same reason will lead in the near future to the building of a branch line from Spence's Bridge to Nicola, where there are extensive deposits of good steam coal. The Dominion Government subsidized this at its last session and it will undoubtedly be constructed during the present year. This will, for the first time, give a local coal supply to the extensive district lying between Banff and the coast.

This brief review would not be complete without reference to the terrible catastrophe which occurred at Frank, in April last, when a mountain slide containing, according to the best authorities, not less than one hundred million tons, crashed into the valley beneath—covering four square miles to an average depth of thirty feet, destroying two miles of railway, with all the mine buildings, plant and machinery of the Canadian American Coal and Coke Company and sacrificing over eighty lives. The opinion of experts, who examined the location of the mine subsequently, attributed the catastrophe mainly to the fact of the mining operations in loosening the side of the mountain, and Messrs. McConnell and Brock the Government geologists, who reported specially on the matter, confirmed this view. A very ill advised attempt to continue operations by the company was made and ultimately abandoned in December. In view of the general opinion that the western peak of the mountain, which is deeply fissured, will yet fall and that the spring thaw will be sure to bring it down, undoubtedly the wise course was to abandon operations, which should never have been permitted after the catastrophe in March last.

Altogether the year's work in "black diamonds" has been of a most progressive and profitable character and the prospects for the future are bright. There is probably no Canadian industry which offers better inducements or which rests upon a sounder basis.

Crown Land Grants in Nova Scotia.

The history of the land grants in Canada leads to the regret that the mining engineer had not been evolved at an earlier date. While there have always been bold miners who dared, and did, the utmost the science of mining allowed, before the beginning of the last century, there were few if any who were competent in matters mineral.

Had the early claimants of this continent founded a continuity of policy, and had their descendants been able to maintain it, then we might have seen in the descended representative of an illustrious grandee a monopoly of its minerals far surpassing the steel, and all other combines united.

In the case of Nova Scotia, however, the general grants of the region, known as Acadia, came to an end with the capture of Annapolis in 1710. The titles granted by the French and the English Governments previous to that date being ignored except on certain conditions of possession and allegiance. The titles of the French settlers, which do not appear to have included minerals, were finally forfeited in 1755. The English Government proposed to settle the province with settlers from England; but the pressure of continental wars postponed consideration of the project.

The province being administered by parties favoring the New England Colonies the best lands of the province were peopled from that source. Numerous townships were laid off and gradually settled. From 1731 to 1763 the royal metals, precious stones, and lapis lazuli were reserved. After that date the reservations were increased by coal, lead, and copper, down to 1808. Some undiscovered system, or want of system, governed all these grants, granting or receiving certain minerals apparently at the whim of some irresponsible official. From 1808 to 1827 iron ore was added to the list of reservations.

In 1827 the Government of England granted to the Duke of York, all ungranted mines and minerals in the province. He tranferred his grant to the General Mining Association of London, who devoted their attention exclusively to the mining of coal. This grant effectually damped all interest in matters mining. Finally after much public agitation the company surrendered their monopoly, retaining only several tracts of coal land. After wresting this valuable franchise from the company, the government having ownership of the minerals under large tracts of land, might have made provision for leasing them, etc.

MR. THOMAS CANTLEY, NEW GLASGOW, N.S.

Who succeeds Mr. Graham Fraser as Managing Director of the N.S. Steel and Coal Co. Limited.

Instead of this they immediately vested all minerals in the grants issued between 1827 and 1858 except gold, silver, coal, lead, tin, copper, iron, and precious stones. This uncalled for benevolence would not have taken place had they had the benefit of proper professional advice. It was not until 1892 that the government of the province awoke to the fact that there were in addition to the minerals reserved in 1858, others of value, and capable of contributing to the public revenue. Since that date all minerals are reserved except limestone, gypsum, and building material.

The result of this variegated granting of minerals has been baneful in the private grants. In the case of the township, and other large consolidated individual grants, it would not have given rise to much difficulty had the grants been all divided and settled on. As many grantees did not occupy their lots, and vacant lands in the grants have been occupied by squatters and relocated under later grants the procury of title to minerals, the presumed property of the owner of the land is attended with much difficulty. Imperfect surveys and descriptions, non-division of property, squatters' titles, etc., all unite to make the task of searching titles one of much difficulty and doubt.

Legislation is needed to give investors proper titles from the Crown, while protecting any rights acquired by the ancient grantees.

Similar difficulties have arisen in the other older provinces of the Dominion. In Ontario these difficulties have been met with and have been more or less removed. The experience of Nova Scotia should however be of interest to the newer and future additions to the federation of the Dominion.

Full and careful expert advice should be taken and legislation so framed as to preserve to the Crown those minerals which may be of value. The system of Crown mineral leases secures in perpetuity the issue of good and unimpeachable titles. The title to minerals held by owners of the soil becomes in time as indefinite as the land titles. This is more specially felt in comparatively new countries, when small lots of land are granted to people, who in a few years are liable to move to more promising sections and leave titles that can be cleared only after much trouble.

The dimensions of grants in many cases do not coincide with the limits necessary for a proper mining investment. This can be effected most satisfactorily when the mineral title is controlled by only one authority or ownership.

The Canadian Copper Company's Plant at Copper Cliff, Ontario.*

The drawings shown herewith are plan and sectional elevations of a 1,000-ton smelter designed by the Engineering Company of America, New York, and erected at Copper Cliff, Ontario, for the Canadian Copper Company, a subsidiary corporation of the International Nickel Company of New York.

There were several objects that had to be borne in mind, among them the cheap handling of a large tonnage of ore, the storage during the winter months of materials, such as coke and coal, which can be received by boat during summer, the elimination of all needless manual labor, and the thorough efficiency of the power department. The plant was designed to be erected on two levels; the large amount of slag produced had to be taken into consideration, and the disposition of this slag was an important factor in determining the site. The plant, as it now stands, was built along the face of a cliff on the northern side of the deep valley in which the town of Copper Cliff stands.

The problem was to take the roasted pyrrhotite from roast heaps and convert it into 80 per cent. matte, the presence of nickel precluding the advisability of a higher concentration.

On the upper edge of the cliff a system of bins has been constructed for storage purposes. The smelter building proper is situated parallel to these bins with the power-house at the eastern end. A trestle was built on the grade level of the bottom of the bins, which is also the grade level of the charging floor connecting the charging floor with the bins and also with the power-house, making a circular track, without switches, running on both sides of the furnaces and passing the coal chute in front of the power-house, which leads directly into the boiler room.

The scheme of operation is as follows: Three miles from the plant is the largest mine. The ore is taken from this mine to the roasting-beds, which are about one-half mile from the smelter. After roasting, the ore is loaded into hopper-bottom cars and drawn up to the top of the bins. The track leading to the top of the trestle is on an easy grade all the way, and is also connected with the main track leading to the Canadian Pacific Railway.

All ore, flux, coke, coal, etc., is handled on these tracks and dumped directly into the bins. Running on the circular track underneath the bins and into the smelter building and past the power-house is an electric railroad, with side-dumping cars drawn by electric locomotives. The ore, coke, etc., is loaded into these cars, weighed on the end of the trestle and dumped into the coal chute next to the power-house. All trains are kept moving in one direction, and there is no switching or cross-over.

As shown by the sectional elevations, the site consists of two levels with a difference of 35 ft. in elevation. The upper level is the same elevation as the feed-floor, and is occupied by a double-track pocket trestle 32 by 34 by 600 ft. The storage pockets were made to hold enough coal to last over the period of closed navigation; coal being received by boat at a near-by port on Georgian Bay, as well as coke, ore, silica and clay.

On the lower level are located the power-house, 156 by 102 ft.; the blast-furnace building, 84 by 283 ft.; the foundations for the trestle carrying the electric tramway, connecting the storage pockets with the feed floor; the coal-bins of the boiler-room; the dust chamber 16 ft. wide, 18 ft. high and 444 ft. long; the stack, 15 ft, inside diameter, 210 ft. high; together with the necessary slag tracks, sunken track for loading metal for shipment, tracks to storehouse, etc.

The power-house is equipped with two Nordberg Manufacturing Company's horizontal, cross-compound, condensing blowing engines with steam cylinders 13 in. and 24 in. by 42 in. and air cylinders 57 in. and 57 in. by 42 in. When operating under usual working conditions these engines will deliver 20,000 cu. ft. of free air per minute against a pressure of 40 oz. for use in the blast furnaces. One Nordberg Manufacturing Company's horizontal, cross-compound, condensing blowing engine, with steam cylinders 15 in. and 30 in. by 42 in. and air cylinders 40 in. and 40 in. by 42 in. This engine will deliver 10,000 cu. ft. of free air per minute against a pressure of 15 lb. for use in the converters. Two 13 in. and 26 in. by 20 in. horizontal compound condensing engines built by the Robb Engineering Company, to each of which is directly connected one 200 kw. 600-volt 3-phase alternating current generator built by the Canadian General Electric Company, each generator having its own exciter of 11 kw. capacity belt driven from generator shaft. The electrical energy thus generated is used for hoisting and pumping at the mines, operating the electric tramway for charging cars, turning the converters, and operating the traveling crane in furnace building. The station is also equipped with one 25 kw. motor driven generator set, for furnishing direct current to the electric locomotives. A travelling crane of ample capa-

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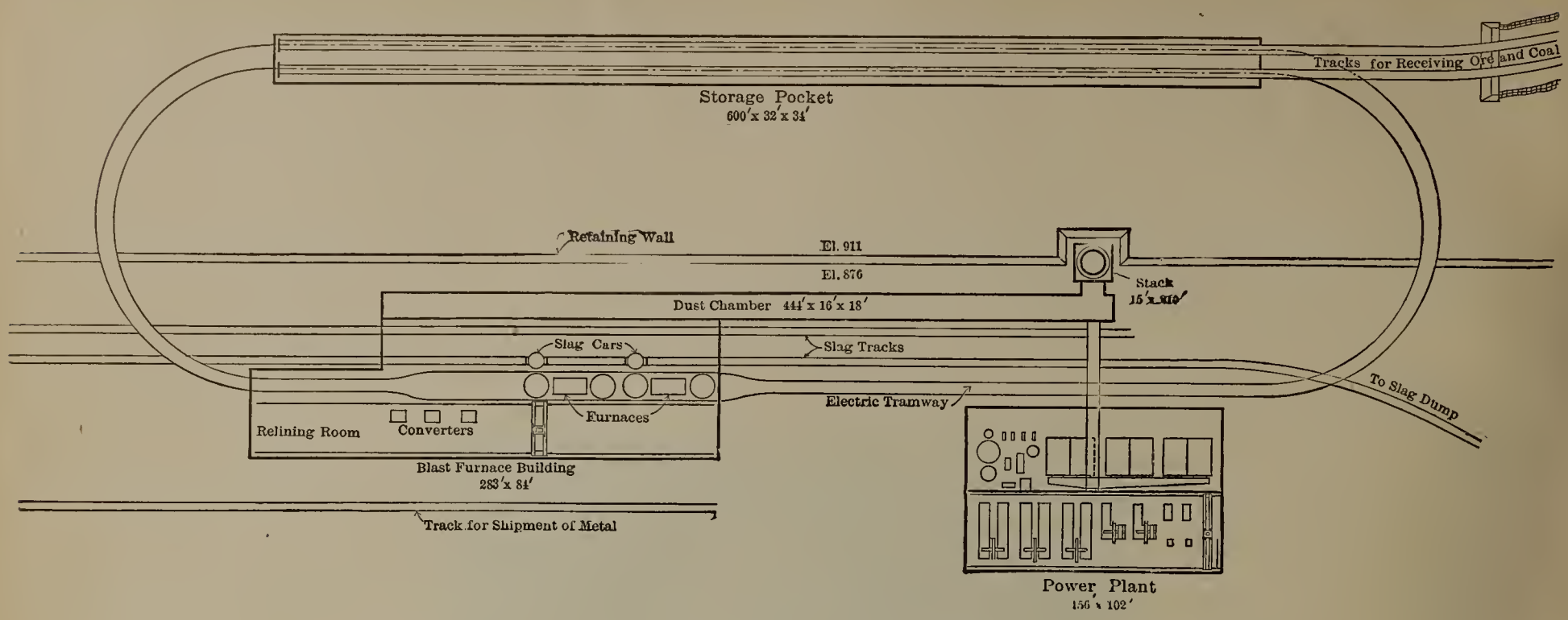
DR. EUGENE HAANEL

Dominion Superintendent of Mines, now *en route* for Europe on a Commission to investigate the application of electro-metallurgy to Canadian iron ores.



PLAN OF WORKS AT COPPER CLIFF.

city is installed in the engine-room for handling all this apparatus. A gravity oiling and oil filtration system is installed on all engines.

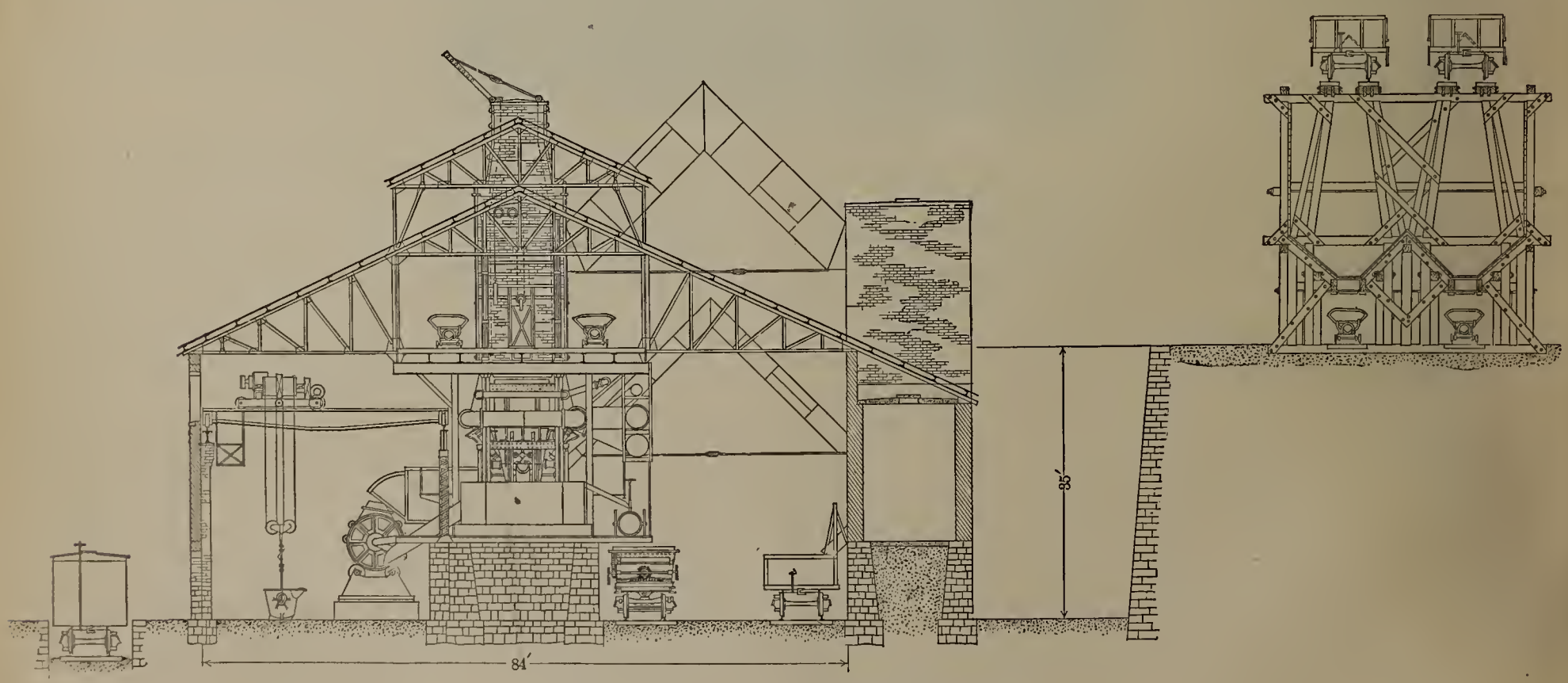
In the boiler room the present installation of boilers consists of four 400-h.p., 150-lb. pressure, horizontal water-tube boilers built by the Aultman & Taylor Machinery Company, of Mansfield, Ohio, and space is provided for two more boilers of the same size. The boiler furnaces are equipped with Tread-Kill shaking grates. The ashes are removed from the boiler ash-pit by opening a grate in the bottom, which permits them to fall into a bucket resting on a small flat car, which runs on a track in the ash tunnel under the boilers. The car is then run outside of the building and a hoist lifts the bucket and dumps the ashes into an ash-bin, from which it runs into cinder car.

Coal is brought to the power plant by the electric locomotive train above referred to and dumped into bins built in trestle along the west side of building. Then it runs through coal chutes to one-half-ton coal cars in boiler room, from which cars it is shoveled into boiler furnaces.

The only available water for boiler use contains considerable sulphuric acid and scale-forming elements, and, to eliminate these, the water is subjected to a chemical treatment and precipitation in a water purifying system built by the Industrial Water Company, of New-York. In this way the acid is neutralized and the scale-forming material is removed before the water enters the boilers. The condenser is of the elevated barometric type, built by the Alberger Condenser Company, of New-York.

The blast-furnace building contains two Holthoff copper blast-furnaces; three stands for Holthoff converters; one 40-ton electric crane; the necessary matte-settlers, clay mills, silica and clay storage bins, etc. Room is provided for expansion.

In operation the ore, coke and flux far blast-furnaces, silica and clay for lining converters, and coal for boilers is delivered into the top of the trestle pockets by standard-gauge cars—Ingoldsby side-dumping in the case of ore—and drawn from the bottom of the pockets into trains of six 2-ton, 36-in. gauge, side-dump Koppel cars, which are hauled to the blast-furnace, silica and clay storage bins or coal bins by 25 h.p. Canadian General Electric Company's electric locomotives. When feeding the blast-furnaces, a train of six cars will be made up of



SECTION OF SMELTER AT COPPER CLIFF.

four cars containing two tons of smelting mixture and two cars each containing the proper amount of coke to go with four tons of charge.

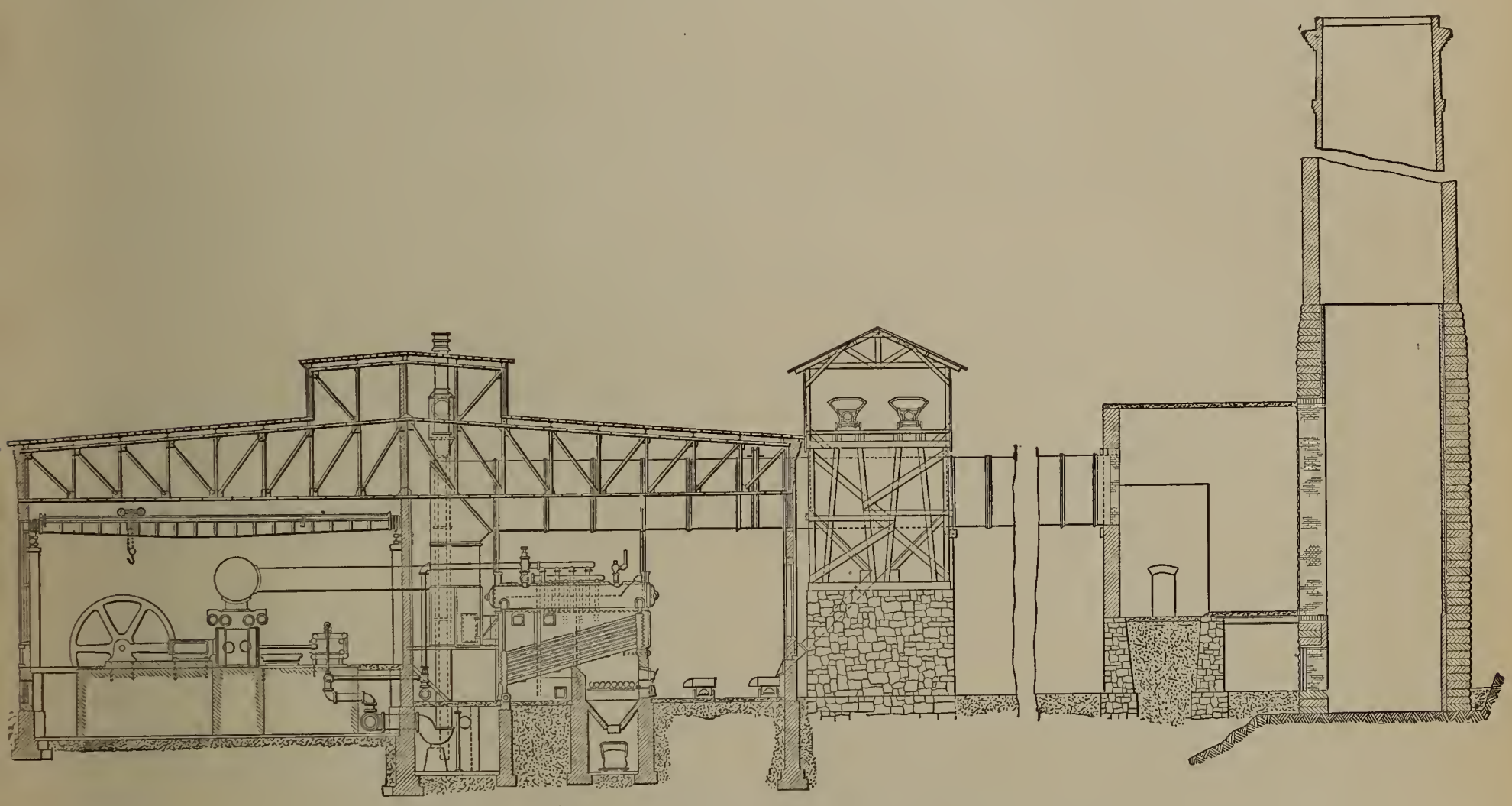
The slag and matte runs from the blast-furnace into 16-in. settlers, the slag overflowing into 225 cu. ft. capacity Pollock cinder cars, which are hauled to the dump by standard-gauge locomotives. The matte is tapped into 10-ton cast-steel ladles and taken to the converter by a 40-ton Case Manufacturing Company's electric crane. The same crane removes the converter shells for re-lining, and takes care of the converter slag and white metal, pouring them into moulds for return into the pocket trestle, or for shipment to the refinery. The coal bins at the boilers and the silica and clay bins at the clay mills are kept full by six-car train-loads of material.

The flue dust is drawn from the dust chamber into a standard-gauge, bottom-dump gondola especially fitted for the service, and this car is hauled to the top of the pocket trestle on the upper level and the dust drawn into a pocket fitted for the purpose, whence it is drawn to a briquetting machine, pressed into briquettes and added to the charge.

The electric tramway consists of two parallel 30-in. gauge tracks running under two lines of grates under the pocket trestle, then over suspension scales to opposite sides of the furnaces on the feed-floor level, passing over the top of the boiler room, coal bins and converter lining house, silica and clay bins. The two tracks have cross-over connections but under normal working conditions each track carries a train entirely independent of the other.

The blast-furnaces are 50-in. by 204 in. at the tuyeres ; 14 ft. 9 in. from center of tuyeres to the feed-floor, and have on each side four lower jackets each 51 in. wide and 8 ft. 6 in. high and two upper jackets 8 ft. 6 in. wide and 6 ft. high. Each lower side-jacket carries four 6-in. tuyeres. Both ends of the furnace are made alike, so that either end can be used for removing matte and slag. There is no brick work under the deck beams. The converters are 84 in. by 126 in. and are tilted by a train of gears and a worm, driven by electric motor.

The water for the plant is supplied by a 16-in. diameter pipe running from a dam situated about 5,000 ft. from the plant itself. The water is run by gravity into the jackets, and when drawn out is pumped into a tank above the smelting plant for fire purposes, or into the reservoir, which is near the foot of the plant, and the hot water is also used in the boilers in order to economize at that point.



SECTION OF WORKS AT COPPER CLIFF.

On the Manufacture of Sulphuric Acid at Sydney, C.B.

By C. A. Meissner, Sydney, Cape Breton.*

The manufacture of sulphuric acid for the purpose of making sulphate of ammonia, or the uses in the sulphite wood pulp industry, is one of the branches of the coke department where coke is made in patent ovens and the by-products are saved. Ammonium sulphate is made from the ammonia in the gas from the ovens, which is washed out and the resulting gas liquor is mixed with milk of lime which liberates the fixed ammonia and passes through suitable stills where it comes into contact with steam. By this means the free and combined, or fixed, ammonia is given off in gaseous form, and then passed into sulphuric acid contained in lead lined tanks. This acid is the ordinary chamber acid of 54° to 55° Beaume diluted down to about 42° Be.

Usually the sulphuric acid is made near the by-products plant in which it is to be used, unless commercial acid is readily and economically available, and distances from acid factories and suqsequent freight rates are not too high.

Sulphuric acid is made largely out of iron or copper pyrites,—$Fe\ S_2$ and $(Cu_2\ S)\ (Fe_2\ S_3)$—also from native sulphur. In some cases the nickeliferous pyrites are roasted and the nickel subsequently extracted, as well as the copper. Arsenical and auriferous pyrites are used in some cases and the arsenic and gold extracted. Zinciferous sulphur ores are beginning to be largely used for this purpose, and are liable to become an important factor. Native sulphur running

* Paper to be presented at the ensuing annual meetings of The Canadian Mining Institute.

from $17 to $20 per ton is, as a rule, too expensive against the price of pyrites containing 50% sulphur at $4.50 to $6.50 per ton and is used when not too far from source of supply. In this country it is largely used in the manufacture of the sulphite wood pulp process. Strong efforts have been made to find additional native sulphur deposits besides those now well known, but so far no new large deposits have been brought into the markets and the price of native sulphur has not been reduced much in late years. The deposits in some of the West Indian Islands, and also some of the Alaskan group of Islands, are not yet figuring in the market to any extent.

So far, in the States, the importation is nearly double the home production.* In Canada comparatively small amounts of pyrites are mined, something over 35,000 tons being the total production for 1902. This comes largely from the mines at Eustis and Capelton in the Eastern Townships of the Province of Quebec. As yet no iron pyrites mines have been discovered that are of any extent, although the whole country, especially in the Lower Provinces, is heavily impregnated with pyrites in small particles, seams, or pockets, in practically all classes of rock. New locations in Lower Canada have been examined, but so far without direct economic success.

Newfoundland has produced some large deposits, some of which have already stood the test of time. Others, however, are still in the development stage, and later I will describe some of the deposits in the Labrador Districts which give promise of being large producers after being properly developed. The Pilley Island deposits in Notre Dame Bay, Newfoundland, are again producers, after having been idle for a number of years. At one time it was a well known deposit, having produced over 400,000 tons before being shut down. It, like nearly all Newfoundland pyrites, is very pure as far arsenic is concerned, and usually high in sulphur.

Physically, these Newfoundland ores are largely hard and fairly compact, some exceedingly so, as for instance the Labrador varieties, and with care the amount of fines is not excessive.

Copper pyrites are worked on a paying basis in several locations in Newfoundland, and such mines as Tilt Cove and York Harbour are, and promise to be, steady producers. York Harbour in the Bay of Islands, particularly, promises to be a large and steady producer. Along the Labrador Coast pyrites deposits have been reported, of which the Rowsell's Harbour deposit is, so far, the only one that has been carefully investigated. This is the one that I will describe fully later.

From this preliminary sketch on the sources of supply, we will now turn to the manufacture of sulphuric acid at the Dominion & Steel Company's Acid Plant, in Sydney, Nova Scotia, as described by Mr. C. Carter, Superintendent of the Plant.

The manufacture of sulphuric acid, as at present carried out by means of what is known as the chamber process, is the result of many years of study and observation, combined with the application and adaptation of materials and methods to the circumstances existing from time to time. Whilst other processes for the manufacture of acid have been brought out and developed, the chamber process remains to this day the most important of them all.

The object to be attained in this and other processes is to be bring about the combustion of sulphur dioxide gas (SO_2) derived from the combustion of sulphur with the elements of water (H_2O) and an additional atom of oxygen (O) to form sulphuric acid (H_2SO_4)

$$SO_2 + H_2O + O = H_2SO_4$$

As a chemical equatation, this reaction appears to be of the simplest kind, but as a matter of fact and practice, the combination does not occur in quite such an easy manner, for, whilst the first part of the reaction, viz, the combination of the sulphur dioxide with the water, is readily brought about with the formation of sulphurous acid (H_2SO_3), the greatest difficulty is experienced in getting this sulphurous acid (H_2SO_3) to combine with the extra atom of oxygen to form sulphuric acid (H_2SO_4).

The principal sources of supply of sulphur for the manufacture of acid are (1) brimstone, (2) iron and copper pyrites, and (3) spent oxide from the purifiers of gas works. Of these the pyrites are by far the most important sources, most of the acid at the present day being made from these substances.

It may here be convenient to give a brief outline of the process, returning afterward to discuss more closely each stage of the process in detail. Broadly speaking, the pyrites are burnt in suitable kilns or burners, and sulphur dioxide gas given off. This gas passes along through a flue into the nitre oven where a mixture of nitrate of soda and sulphuric acid is decomposed by the heat of the burner gas, and nitric acid vapours given off which travel on with the burner gas into what is known as the Glover tower, the object and working of which will be described later. The gas rises through this tower and passes from the top through a flue into a series of leaden chambers, where it comes into contact with water vapour in the form of steam introduced through the sides or tops of the chambers. In these chambers the reaction between the gases and steam takes place, resulting in the formation of sulphuric acid which falls to the bottom of the chambers as a fine mist, where it accumulates as a liquid known as chamber acid. From the last of the series of chambers, the residual gas passes through another flue into the bottom of the Gay-Lussac tower, up which it rises, and in which the greater part of the nitrogen acid gases derived from the nitrate of soda are recovered and made available for being used over again. From the top of the Gay-Lussac tower the remaining portion of gas, which consists almost entirely of air, passes out into the surrounding atmosphere.

Having given this very brief sketch of the process, it may now be convenient to discuss each step more in detail.

The kilns, or burners, in which the pyrites are burnt are usually built in sets, back to back, of 12 to 24, or more, burners, and are constructed of brick lined inside with firebrick. The internal dimensions are about 8 feet high, by 4 ft. 6 ins. wide, by 5 ft. to 6 ft. deep. About 2 feet from the ground is placed a set of grate bars. each bar being free to move around its axis, so as to allow the burnt cinders from the pyrites to pass through. The front of the burner consists of a cast iron plate fitted with three tiers of doors, the lower one being placed convenient for removing cinders from below the grate bars; the next higher on a level with the grate bars so as to enable the men in charge to get at and turn around from time to time. The upper door is placed about three feet higher, and through this the charging is done. It is fitted with a small sliding door to enable the interior of the burner to be observed without having to open the larger door. In the roof of the burner is a square hole about 12 inches square communicating with a flue passing along the whole length of the set of burners, and into which every separate burner discharges the gas from its pyrites.

In starting up a set of such burners, a layer of cinders is placed on the grates about 18 inches in depth, on which the pyrites is ignited by suitable means, the charge of ore being about 700 lbs. for every twenty-four hours. Each burner in a set receives attention in rotation every twenty-four hours, the cinders being shaken down into the ash pits, and a fresh charge being put in on top, the new charge being ignited by the heat of the previous charge. In the ash pit door are some small doors capable of being regulated, through which the air required for combustion of the sulphur is allowed to enter.

The heated gas from these burners, which consists essentially of a

*See Mineral Industry.

mixture of sulphur dioxide and air, passes through the flues into the nitre oven. This is an enlargement in the flue containing two cast iron pans set in in such a manner that the heated gases can play well over and around them. These pans are about 7 ft. long by 2 ft. wide and 1 ft. deep. Through an iron door in the wall of the oven charges of nitrate of soda, together with sufficient sulphuric acid to completely decompose the nitrate, are introduced at regular intervals. The heated gases warm up this mixture and keep the reaction going. Nitric acid gas being given off, which is carried off along with the burner gases into the next stage of the process. The sodium sulphate ($NaHSO_4$) resulting from the action of the sulphuric acid on the nitrate of soda is withdrawn from time to time through a channel in the bottom of the pan, and is allowed to cool and solidify. In some cases this substance is utilized by working it up with common salt into salt cake in the manufacture of carbonate of soda, and also in glass making, but in many places it is useless and simply thrown away.

The gases which leave the nitre oven next pass into a tower called after the name of its inventor, the Glover Tower. This tower consists of a hollow column of sheet lead, from 20 to 30 ft. high, and 9 or 10 ft. square, held in an upright position by a strong timber at each corner carrying joists to which the lead is attached by straps of the same metal. The lower end of the lead tower stands in a saucer made of the same material, about 1 ft. wider every way than the lead column, and about 1 ft. deep. This saucer is provided with a lip on one side to carry off the acid which runs through the tower and out at the bottom. The interior of the tower is lined with a glazed metallic brick, such as will resist the action of the acid, This brick is built up into the form of an arch over the pipe which brings the gas from the burners, the roof of the arch being arranged as a grating to break up the gas into a number of streams. The walls of the tower are then lined with the same brick up to the top, the lining being graded upwards from a brick and a half thick at the base to half a brick at the top. These bricks are all laid dry without mortar or cement of any kind. The space within the brick work is then filled in with quartz or flints, graded in size from the largest pieces at the bottom to the smallest sizes at the top, the packing being filled in to within about 4 ft. of the top of the brick lining. The top of the tower is covered in with a sheet of lead which is perforated with a number of holes placed about 2 ft. apart over its surface and fitted with funnels and lutes in such a way that acid can flow down into the tower without allowing the gas to pass up through the lutes.

Above the top of the tower is erected a chamber containing two distributers and storage tanks of lead for holding and delivering the acids which are allowed to run down the tower. The distributers are of many kinds. the main idea being to divide up the stream of acid from the storage tank into a number of fine streams of uniform amount and deliver these at the different holes in the top of the tower. In the side of the tower above the brick work, and below the top sheet, a leaden flue is affixed to convey the gas from the top of the tower into the first of a series of chambers. The objects of the Glover Tower are two-fold : (1) to denitrate the nitrous acid obtained from the Gay-Lussac tower in a later stage of the process, and restore the nitrous gases to the system; and (2) to concentrate the acid running down the tower. These objects are attained as follows :—

Strong sulphuric acid, containing nitrous acid gases in solution, possesses the property of giving off these gases as reddish fumes when it is diluted with water or a weaker acid. Advantage is taken of this property in the Glover tower by having two tanks at the top, one containing the nitrous sulphuric acid and the other water or weak acid from one of the chambers. Various names are given to this nitrous sulphuric acid. By some it is known as nitroso-sulphuric acid, whilst in the trade it is usually termed nitrated acid or nitrous vitriol, the last name being used hereafter. A pipe from each tank leads to one of the distributers, the nitrous vitriol being piped to one, and the water or weak acid to another. A stream of water or acid is started, and both mix at the funnels leading into the tower. The acid on dilution gives up its nitrous gases which are carried into the chambers again by the ascending column of gas. The mixed liquids fall down on to the quartz packing and are divided up into countless little streamlets descending the tower, and cooling the gases as they rise through the interstices of the packing. Lower down the gases are hotter, having just left the burners, and here the heat is sufficient to drive off the water from the descending shower of acid and returns it as steam to the chambers, whilst the acid runs out into the saucer at the base of the tower, and from there into the storage tank, as strong as it was before dilution at the top of the tower, and at the same time deprived of the nitrous acid which it formerly contained. The degree of denitration and concentration is regulated by varying the supply of water or weak acid at the top of the tower, the acid running away from the base of the tower, being tested frequently for strength and nitrous acid. If this shows a high test for nitrous acid, more water or weak acid is required, whilst if the strength is below the normal, some water or weak acid must be cut off. The acid which runs off from the base of the tower is passed through a cooling arrangement to reduce the temperature as much as possible, and is then in a suitable condition to be used over again in the other tower or Gay-Lussac tower in a stage to be described later.

The mixture of gases which reaches the top of the Glover tower and which consists of sulphur dioxide, nitrous acid gas (N_2O_3), steam and air pass through the flue into the first set of chambers, the temperature of the entering gases being about 140° F., though it sometimes falls as low as 100° F. in very cold weather, such as we occasionally experience in Sydney.

The chambers, which have been mentioned previously, are enormous receptacles constructed of sheet lead. They are usually built in sets of 3, 4, or more, according to the capacity of the plant. Sometimes all the chambers are of the same size, about 90 ft. long by 24 ft. wide and 24 ft. high, containing about some 50,000 cubic feet of space each inside. In other plants, as at the Dominion Iron and Steel Company's plant the chambers are of varying sizes, the first chamber being the smallest and the last one the largest. There is not, however, any distinct advantage apparent of one plan over the other. The Steel Company's plant consists of three chambers, the first one being 36 ft. long, 25 ft. wide and 20 ft. high, having a capacity of 18,000 cu. ft.; the second being 117 ft. long, 25 ft. wide and 20 ft. high, with a capacity of 58,500 cu. ft.; and the third being 150 ft. long, 20 ft. wide, and 20 ft. high, with a capacity of 60,000 cu. ft.; the total contents of the three chambers being 136,500 cu. ft. In the construction of these chambers, the base of each chamber is essentially an immense lead tank, with sides two feet high. Into this the leaden sheets forming the sides of the chamber hang almost touching the bottom of the tank, the acid formed in the tank acting as a lute around the lower edge of the sheet to prevent the gas from escaping. The top of the chamber is a lead sheet. The sheets are joined together by burning, a blow pipe, using oxy-hydrogen gas, being used to melt the edges of the sheets sufficiently for the metal from the two sheets to run together and solidify. Solder would be of no use, as it would not resist the action of the acid gases. The leadwork is held up by a strong wooden framing, built up all round outside, to which the sides and top of the chambers are attached by lead straps burnt to the sheet lead and nailed to the joists. A set of chambers is usually raised some ten or more feet above the ground to allow for a natural fall of the acid when

drawing it off from the chambers for use. The chambers are connected one with the other by means of leaden flues about 2 to 3 ft. in diameter through which the gases travel from one chamber into the other. Each chamber has several fittings. First of all one or two steam jets are inserted in the sides or top connected outside with a steam supply and valves so that the admission of steam can be controlled. On one side of the chamber at intervals of 20 ft. or so, a tray 10 ft. long by 1 ft. wide is attached inside the chamber about 5 ft. from the bottom. This tray is placed on a slope of about 1 in 12, and at the lower end a tube of about 1-in. bore communicates with the tray and the outside of the chamber by passing through the side. When the chamber is working, some of the condensed acid collects on this tray and runs out by the tube where it is received in a hydrometer glass and tested for specific gravity at regular intervals, by means of which it is known whether too little or too much steam is being admitted. Thermometers are also inserted through holes in the side to indicate the temperature of the interior and a place is made at each chamber either by means of a manhole or by pressing back some of the leadwork for obtaining samples of the acid standing in the bottom. In these chambers, the formation of the sulphuric acid takes place. Various theories have been advanced for explaining the formation, none of which, however, can be accepted with absolute certainty. The most generally accepted theory, however, is that the sulphur dioxide (SO_2), the nitrous acid from the nitre ovens (N_2O_3), the oxygen from the atmosphere, and the steam generated in the Glover tower react in the first chamber producing nitroso-sulphuric acid in accordance with the equation—

$$2SO_2 + H_2O + O_2 + N_2O_3 = 2SO_2\,(OH)(ONO)$$

This nitroso-sulphuric Acid floats about the chambers as a mist, and on coming into contact with more water vapor from the steam jets is decomposed with the production of sulphuric acid, which sinks to the bottom of the chamber, and nitrous acid gas (N_2O_3) which is available for further reaction, this reaction being capable of representation by the equation—

$$2SO_2\,(OH)(ONO) + H_2O = 2H_2SO_4 + N_2O_3$$

Thus the nitrous acid gas acts as a carrier of oxygen, bringing about the combination of the sulphur dioxide with the extra atom of oxygen required to form sulphuric acid. This reaction goes on over and over again right through the set of chambers, the action of the first chamber being the most energetic, as shown by the higher temperature of that chamber, which in the other chambers gradually falls until at the outlet from the last one it is about the same as that of the atmosphere. It is the duty of the chamber attendant to go round the chambers every hour and observe the specific gravity of the samples obtained from the test tables inside or the "drips" as they are called, and from these observations he judges whether more or less steam is to be admitted. The liquid acid, as it is formed, settles in the bottoms of the chambers, from which it can be syphoned off, whenever required, for any purpose for which it is made.

By the time the gases have reached the end of the set of chambers, the reaction should be theoretically completed, the residual gases consisting of nitrous acid gas (N_2O_3) and air only. In practice, however, this is never the case, there being always traces of unaltered sulphur dioxide in the gases leaving the chambers. In the early days of the chamber process, these gases were at once allowed to go out into the atmosphere, which meant that a large amount of nitrous acid gas was continually escaping and so being lost. Thanks, however, to the invention of the French chemist, Gay-Lussac, it has been found possible to recover the greater amount of this nitrous acid gas and render it capable of being used over and over again, and so economizing to an enormous extent the quantity of nitrate of soda formerly used.

[TO BE CONTINUED]

The Year's Mining in British Columbia.*

The mining of gold and silver-bearing ores in British Columbia continues to be done chiefly in a very small part of the province, namely, the southeastern corner, comprising the district of Kootenay and a portion of Yale, all of it being south of the Canadian Pacific Railway.

The following table represents approximately the output of the year 1903:

	Ore, tons.	Gold, oz.	Silver, oz.	Copper, tons.	Lead, tons.
Boundary district.....	684,000	48,000	247,000	8,245	.....
Rossland.....	406,200	164,700	467,000	4,125	.....
Nelson.....	84,000	24,300	207,000	195	550
Slocan and East Kootenay.....	22,100	3,400	2,375,000	.....	9,295
Miscellaneous	13,700	7,600	4,000	.....	.....
Total	1,210,000	248,000	3,300,000	12,965	9,845

As compared with the output of 1902 there is an increase of over 200,000 tons, of ore, an increase of about 17,000 oz. gold, and a decrease of 600,000 oz. silver The ultimate reasons explaining these changes are to be found under the headings 'Copper' and 'Lead.' It is to be noted, however, that the tonnage mined in the extremely low-grade district of the Boundary is 56.4 per cent of the total. The average ores of the Boundary are found to yield about .07 oz. gold, 0.35 oz. silver and 1.2 per cent copper. The precious metals are therefore less in value than the base.

A few small mines of this Boundary district, all in the vicinity of Greenwood, are producing quartz ores with about 4 to 5 oz. gold and 50 to 60 oz. silver per ton. Allowance for such material makes the profitable mining of the copper-bearing ores all the more remarkable.

In the Rossland district there has been a radical increase of tonnage and metal recovery. Here the main value is in gold, the ores averaging, as now mined, about 0.45 oz. gold, 1.1 oz. silver, and 1.1 per cent copper. Continuance of operation at the more important mines, therefore, indicates a greatly decreased cost of either mining or smelting, or both, as compared with that which prevailed only five or six years ago, when freight and smelting charges amounted to from $9 to $11 per ton.

The year 1903 has witnessed the apparently successful introduction of the Elmore process, and its success in concentrating the low-grade ores of the Le Roi No. 2 mine is leading to its application elsewhere.

The Rossland Water Power Company, affiliated with the Centre Star and War Eagle mines, is now building a large concentrating plant at Trail. The completion of this will undoubtedly lead to a much increased tonnage output in the coming year.

In the Nelson district, the old Silver King mine has been successfully operated in a small way under lease, whilst the milling of free gold ores and the mining of sulphide gold ores at the smaller properties has resulted in an increased tonnage and metal output from them as compared with 1902. The net output of gold is about the same as that of 1902, but that of silver has decreased considerably.

At various outlying camps several 10-stamp gold mills have been built, but they began operations too late in the year to have any marked effect on the output. Including these plants and the older ones, the free milling properties have crushed during 1903 about 95,000 tons of quartz, yielding in bullion 25,000 oz. gold and about 17,000 oz silver.

Slocan, East Kootenay and the Lardeau are producers of the greater part of the silver and practically all of the lead of the province. This lead country has, for various reasons, been far from prosperous,

*By Mr. S. S. Fowler, S.B., E.M., in the *Engineering and Mining Journal.*

with a consequent considerable decrease in the output of dry silver ores; the net result being that the silver output from these districts will be about 600,000 oz. less than in 1902.

In the Similkameen river country, on the eastern slopes of the Cascades, and near Hedley City, the Nickel Plate mine, belonging to the representatives of the late Marcus Daly, has about finished a 40-stamp mill with concentrating and cyanide plants. The ore is quartz carrying arsenical pyrite and, in gold tenor, is said to be much above the average milling ores of the country. This property may be looked to for a large output during the coming year.

Aside from the gold-milling center about Cambourne, in the upper Lardeau and Fish river, the only other district which has attracted much notice during the year is what is now known as Poplar. This camp is situated on the Lardeau river northwest of Kootenay lake, and, although it has not yet reached the stage of commercial production, it has caused much local excitement because of the extraordinary richness of the large quantity of specimens sent out. Development is being prosecuted on several of the more prominent claims, and the coming year doubtless will have added much to our knowledge of this district, which bears the promise of becoming important.

An interesting feature of progress during 1903 has been the construction of a 20-stamp chloridizing mill for the treatment of concentrator tailings from the ore of the Silver Cup mine in Lardeau district. The outcome of this return to an old process will be watched keenly.

Another important undertaking is the preparation for work on an extensive scale of the Hunter V. property near Ymir, 20 miles south of Nelson This mine carries a belt of limestone about 200 ft. wide, which at many points is impregnated with silver minerals to such an extent as to yield about 15 to 20 oz. silver per ton, with small amounts of gold. The rock itself has a large excess of lime and is thus desirable to the local smelters. A tramway of 25 miles length has been built to the Great Northern railway and shipments will begin early in 1904.

Copper.—The production of copper in southeastern British Columbia for 1903 has amounted to 12,965 tons (2,000 lb.), of which 8,245 tons is the result of smelting about 684,000 tons from the mines of the Boundary district near Phœnix and Greenwood, whilst about 4,525 was derived from 406,000 tons produced from the mines of Rossland and its vicinity.

Most of the Boundary ores are smelted at the three local plants of the Granby Company, the British Columbia Copper Company, and the Montreal & Boston Company, none of which are more than 25 miles from the mines. These three plants now have in operation ten large furnaces, whose joint daily capacity may be put at 3,000 tons. Concentration to matte proceeds in the ratio of about 40 tons into one, and the resulting matte averages about 45 per cent copper. All of the matte is converted to blister copper at the works of the Granby Company at Grand Forks, and the products are shipped to New York for refining.

The British Columbia Copper Company is now installing two stands of converters, and it is said to be preparing to double its smelting capacity. These works are being equipped for operation by electric power derived from the plant of the Cascade Water, Power & Light Company, at Cascade, on the Kettle river.

The essentially low grade character of these Boundary mines renders operations on a large scale necessary to success, and as the mines become further developed, the extension of mining and smelting equipment seem certain of justification. The latest announcement of important development work is of that to be undertaken by the Granby Company; this involves the driving of a two-mile adit intended to tap the Phœnix mines at about 1,700 ft. depth. The company also contemplates the erection of another smelting plant near the mouth of this adit, with the ultimate object of doubling the present output.

Two or more properties in this district have been added to the list of shippers during the year, namely, the Oro Denoro and the Athelstane, but the supply of ores sufficiently high in sulphur still seems to be insufficient to permit other than the high ratio of ore to matte above mentioned.

In 1902 the Boundary produced about 520,000 tons of ore and 7,480 tons of copper. The development and advancement of this region is therefore evident. The Granby Company has been placed upon the dividend list.

At Rossland, beside an increase of tonnage amounting to 75,000 tons as compared with 1902, an important and interesting phase of the progress of the district has been the successful application of the Elmore process to the concentration of the lower grade of ores. A 50-ton plant at the Le Roi No. 2 property was finished about the middle of September, and it is stated that its success has already resulted in arrangements for two other plants. Near the smelting town of Trail a concentration plant is being erected, essentially for the benefit of the Centre Star and War Eagle mines. The tailings will be re-treated by a process, the details of which have, I believe, not yet been made public, and also, in part, by the application of the Elmore process.

About 60 per cent. of the Rossland output is smelted at Northport, Wash,and the remainder chiefly at Trail, although latterly a small part has been sent to Greenwood, where the Rossland ore is desirable on account of its greater content of sulphur. The haul of 140 miles and the heavy grade of railway, however, prevent any great part of Rossland ores being smelted at points so far away. At Trail much of the low-grade Rossland ore has been smelted with lead ores.

The general reduction of costs at Rossland, with lower freight and treatment rates, has afforded this district an opportunity of regaining its former strength, and now that concentration has become an efficient factor there appears to be an excellent future for the town.

In 1902 Rossland and the Boundary produced 92 per cent. of all British Columbia copper. The balance came from the mines of Vancouver Island, for which the Tyee and Northwestern companies both built well-equipped smelting plants. I regret to say that I have not received figures of output for the year 1903.

No new copper districts have been discovered during 1903, but more or less quiet development is proceeding in the Similkameen, Nicola and Kamloops districts. Kamloops has shipped small quantities, and it is reported that arrangements are being made for the establishment of a smelting plant at that point. As far as development has proceeded in the Similkameen and upper Upper Nicola camps, the several important properties have proved to be remarkable, both on account of their size and high copper contents. This country is still waiting for the advent of the railway; when that takes place there will be greater stimulus to production.

Lead.—Untill the recently, and for two years past, the conditions surrounding the lead-silver mining industry in British Columbia have been distinctly unsatisfactory. The only available market within easy reach has been in the United States, but free access to it has been precluded by the tariff. The low prices obtainable by the miner for his lead (at present $1.40 per 100 lb.), and the low value of silver, brought the British Columbia lead mines a year ago to a point at which profits vanished and the industry was fast expiring, this was evidenced by a decrease from about 36,600 tons in 1900 to 11,000 tons in 1902. An appeal for assistance was made to the Dominion government last spring; a radical change in the Canadian tariff was asked; but instead of this, the miner had to be content with a bounty of $15 per ton for five years and limited to $500,000 in any one year, on ore mined and smelted in Canada. The decision was reached by the government in

July last, and in December arrangments were finally perfected for the payment of any bounty earned.

Meantime, although silver prices became somewhat better than they were a year ago, the mines, for one reason or another, have not been very actively worked, and the result is that the year 1903 will show a total production of lead of not much over 9,800 tons. Some of this is practically a by-product and would have been produced at any price, from gold ores.

The production of lead-silver ores, as such, will amount to about 22,100 tons, containing about 9,300 tons of lead and 2,375,000 oz. silver, all figures including a rather liberal allowance of output for December. These compare very unfavorably with the figures of 1902, when 31,700 tons of ore containing 10,400 tons of lead and 2,928,000 oz. silver were marketed. It is noticeable that the decrease of silver is very much greater, proportionately, than that of the lead. This is mainly because of the great falling off in the production of the dry silver ores from the Slocan Lake mines. The low prices of silver and a smaller demand for these ores consequent on the decreased production of lead, is responsible for this important change.

During the period of depression, which has lasted so long, some of the lead properties unfortunately, and possibly unavoidably, permitted development work to get very far behind, and it is now undoubtedly a fact that these properties are face to face with depleted treasuries and exhausted ore reserves. Although this remark cannot be applied to more than a few of the mines, it is, still, a condition which together with uncertainty as to when the lead-bounty was to be available, and some professed dissatisfaction as to smelting rates or attempts at having them lessened, has produced a very gloomy year in the lead districts.

Under such circumstances, mine-owners have naturally begun to think more of the possibility of deriving some revenue from the zinc contents of their mines, instead of longer permitting that metal to be a burden on their operations. Considerable interest in the zinc-producing capabilities of the Slocan has been manifest not only on the part of the owners, but, as well, on the part of zinc-ore buyers and the sellers of the various makes of magnetic separators. The net result of this interest in a comparatively new phase of the lead-mining business, is that about 2,000 tons of zinc ore or concentrates have been marketed, and at least one magnetic separating plant has been put in successful operation. Success in turning this hitherto baneful element to account certainly seems to be nearer, for the whole of the Slocan, than it was a few months ago. Most of the product of this class has gone to Iola, in Kansas, at a freight cost of $11 per ton. This charge is greater than the product can well stand, and the feeling is growing that ultimate success is to be reached only by the means of a reduction plant erected in the country, or else a very moderate freight rate to tide-water.

It is interesting to note that, as the result of zinc-milling, in some instances at least, the higher the grade of zinc in the concentrate, the lower the silver values become. This is of importance because of the fact that in the earlier zinc shipments, containing from 40 to 45 per cent. the silver was sold at far too great a sacrifice. Effort towards as perfect a concentration as possible is to be made, therefore, and it is satisfactory to note that at the mill of the Payne mine, a product of 55 per cent. is now being made, with only a very low silver content. The silver minerals are supposed to accompany the magnetic tailings, which may be found to command a ready sale to the lead smelter.

At the close of the year there is found a decidedly better feeling in the lead camps, and it may be expected that, what with artificial assistance of the lead-bounty, the better utilization of the ores, the new 'finds' and any improvement in the prices of silver, 1904 will witness a return of former prosperity.

Excepting about 2,900 tons, all of the product of the lead mines was sold either to the Hall Mining & Smelting Company, at Nelson, or to the Canadian Smelting Works at Trail. At the latter point a new electrolytic lead-refining plant of 20 tons daily capacity was erected during the year.

CARIBOO HYDRAULIC.

Manager Hobson's Report Shows a Poor Year Owing to Lack of Water.

At the Annual Meeting of the Shareholders of the Consolidated Cariboo Hydraulic Mining Company, held in Toronto on 7th January, Mr. John B. Hobson, M.E., Manager of the Company reviewed this work during the season of 1903, as follows :—

The past season turned out a most disappointing one, for the reason that the 26 inches of well-settled snow that laid on the watershed at the end of March, went off mainly by evaporation under the influence of the cold frosty weather, accompanied by the northerly winds that prevailed during the months of April and May ; and afforded barely sufficient water to operate the mines 53 days and 7 hours, with a quantity of water varying from 2,000 to 2,500 miner's inches, being 12 days and 8 hours short of the time run during the season of 1902, 50 days and 18 hours short of the washing time reported for season 1901, and 118 days and 6 hours short of the washing time reported for season of 1900.

The season's mining operations were divided into two runs as follows :—

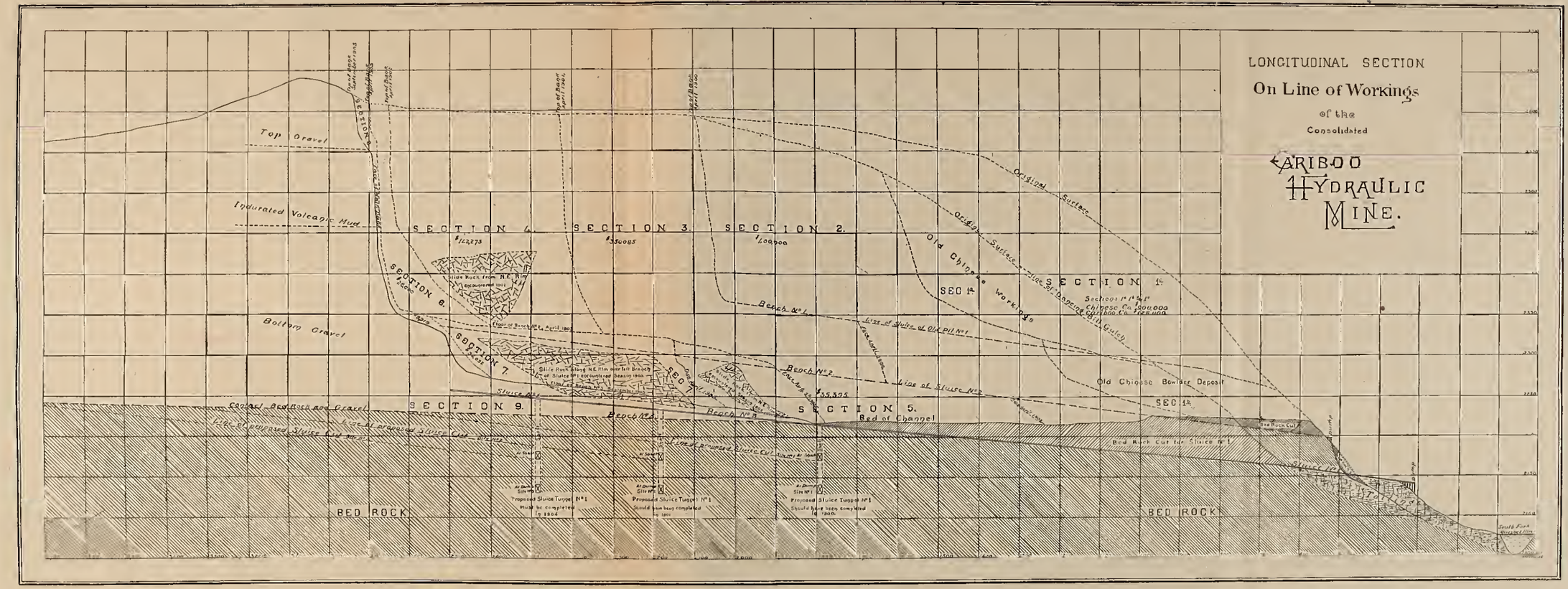
Washing was commenced on the 3rd bench in Pit No. 1 on the 21st day of April, was continued for a period of 45 days and 7 hours, ending July 15th. During the progress of the run 111,083 miner's inches of water were used to wash out a slide of indurated volcanic mud, containing about 68,000 cubic yards, that came into the excavation from the North-West rim on the big bend of the channel north of Dancing Bill Gulch, and 248,000 cubic yards of the rocky deposits of the 3rd Bench, making a total of 316,000 cubic yards for the run, from which was recovered $2,115\frac{85}{100}$ ounces of gold, valued at $36,032.94, an average yield of $14\frac{53}{100}$ cents per cubic yard for the 248,000 cubic yards of gravel and slide rock washed from the 3rd Bench, which was carried up to the face of the Main Bank,

About half the washing time was applied to the excavation of the rocky cuts required to accommodate the right and left branches of Sluice No. 1, which were advanced 740 feet on the right and 704 feet on the left side of the excavation.

The second run, commenced on the 21st day of July, included a period of 8 days, ending with the exhaustion of the water supply on the 1st day of August. During the progress of the run 16,000 miner's inches were used to wash out about 12 000 cubic yards of slide rock that came into the excavation from the South-West rim, and 44,000 cubic yards of gravel from the main bank, making a total of 56,000 cubic yards for the rnn, from which was recovered $523\frac{24}{100}$ ounces of gold, valued at $8,910,76, an average yield of $20\frac{25}{100}$ cents per cubic yard for the 44,000 cubic yards of gravel washed from the Main Bank. The right-hand branch of Sluice No. 1 was advanced 45 feet, making the advancement of Sluices amount to a total of 1,489 feet for the season.

The grade of the deposits of the 3rd Bench increased gradually as the workings were carried up channel towards the Main Bank, but the immense deposits of slide rock, found lying next to the North-East rim, on line of left branch of Sluice No. 1, replaced a large area of the pay strata, and caused a material reduction in the average yield of the ground worked. The removal of this immense deposit of broken, angular rock retarded the progress of the work, and added materially to the cost of mining, and the excavation of cuts required for the advancement of left branch of Sluice No. 1.

The results of the second run is encouraging, and indicates a continuation of the high-grade deposits that gave such satisfactory results prior to the season of 1901, when enormous deposits of slide rock from the rims were found replacing large areas of the high-grade strata composing the Main Body of the fill found between the rims of the ancient river, (see cross and longitudinal sections accompanying reports).


LONGITUDINAL SECTION
On Line of Workings
of the
Consolidated
CARIBOO
HYDRAULIC
MINE.
Top Gravel
Indurated Volcanic Mud
Bottom Gravel
Original Surface
Old Chinese Workings
Old Chinese Bowlder Deposit
Bench No 1
Bench No 2
Bench No 3
Line of Sluice No 1
Line of Sluice No 2
Line of Sluice of Old Pit No 1
Red of Channel
Bed Rock Cut for Sluice No 1
Proposed Sluice Tunnel No 1
BED ROCK
SECTION 1
SECTION 2
SECTION 3
SECTION 4
SECTION 5
SECTION 6
SECTION 7
SECTION 8
SECTION 9

The light gold output may be laid to the short water supply, the working time lost in removing large masses of slide rock, encountered while carrying the workings up stream, and excavating cuts for advancement of sluice branches.

SUMMARY OF THE SEASON'S MINING OPERATIONS.

Total time occupied in washing in Pit No. 1.....53 days, 7 hours
Total quantity of water used.....127,083 miner's inches

Quantity of gravel, clay and rock washed :

Gravel from Third Bench	248,000	cubic yards.
Gravel from Main Bank	44,000	" "
Slides from rims of old workings and Indurated Volcanic Mud	68,000	" "
Bed Rock Slide	12,000	" "
Total quantity washed	372,000	

Average duty of water per miner's inch.....$2\frac{92}{100}$ cubic yards
Gold product for season.....2,639.09 Troy ounces
Value of Gold.....$44,943.70

The receipts and expenditures attending the operation of the company's mines for the season will be found distributed in detail in the following statements :—

MINE OPERATING EXPENSES, 1903.

EXPENDITURE.

Mining Account :—		
Mining	$18,330 22	
Excavation for Sluices	8,703 00	
		$27,033 22
Explosives :—		
Mining	$7,418 15	
Excavation for Sluices	7,120 00	
		$14,538 15
Sluice Maintenance and extension		9,449 80
Portable Hydraulic Plant Maintenance		37 33
Soutn Fork Ditch Maintenance		2,870 28
Morehead Ditch Maintenance		2,815 84
Camp Maintenance		1,189 59
Mine and Camp Light Maintenance		398 46
Wagons and Harness Maintenance		144 07
Telephone Maintenance		77 57
Prospecting Account		729 22
Stationery and Printing		283 47
Postage and Telegraph		134 34
Incidental Expenses		11 40
Lands and Leases, (Lease Purchases, Rentals, etc.)		5,267 30
License Account (Free Miner's Certificates)		110 00
Fire Insurance		803 00
Travelling Expenses (Transportation of Miners, etc.)		6,039 87
Mine Office Expenses		1,307 00
Bullion Expenses (Royalty, Insurance, Transportation, etc.)		1,633 24
Management		5,228 18
Stable Expenses		628 85
Tools and Implements—Loss for Season		288 70
Horses Account " "		190 00
Quicksilver Account " "		242 69
Total Operating Expenses for season		$81,451 57

RECEIPTS FOR SEASON 1903.

Gold Product for Season	$44,943 70
Profit on Stores sold	2,123 19
Total Receipts for season	$47,066 89

INVENTORY.

There is on hand at the Company's Stores and Mines, as per Inventory made August 5th, 1903 :—

Miscellaneous Provision Stores, Mining Supplies, Hydraulic Plant, etc	$42,783 81	
Explosives	20,764 59	
Blacksmith Stores	1,724 63	
Quicksilver	2,644 60	
		$67,917 63
Horses	$ 1,192 00	
Wagons, Sleighs and Harness	2,109 92	
Saw Logs, Lumber, Flats, Fuel, Sluice Blocks, etc	7,943 74	
Tools and Implements	15,557 40	
		26,803 06
Total as per Inventories		$94,720 69

WATER SUPPLY.

The quantity of water available for use during season of 1903 was 52,437 miner's inches less than the quantity of water used during season of 1902, 131,167 miner's inches less than the quantity of water used during season of 1901, and 333,795 miner's inches less than the quantity of water used during the season of 1900.

Precipitation for season 1902	23-40/100 inches
" " 1903	17-48/100 "
Less than precipitation for season 1902	5-92/100 "
Quantity of water available and used during season of 1902	179,520 miner's inches.
Quantity of water available and used during season of 1903	127,083 " "

The winter snowfall turned out again below the average for the district and fell $26\frac{67}{100}$ inches short of that reported for 1902. The spring and summer rains turned out also below the usual average and fell $1\frac{41}{100}$ inches short of the precipitation reported for season of 1902.

The snow went off during the months of April and May under the most unfavorable weather conditions, *i. e.*, moderately warm days, cold nights accompanied with northerly winds and contributed but a small percentage of its water to the reservoir lakes. The unusual shortage in precipitation, together with the unfavorable weather conditions under which the snow went off, accounts for the shortage in the season's water supply.

SUMMARY OF MINING OPERATIONS FROM THE TIME OF COMPLETION OF WATER SUPPLY SYSTEM IN 1898.

YEAR.	Precipitation in inches.	Water used in Miner's inches.	Time Run	Cubic Yds. Gravel Washed.	Product.
1899	28-65/100	353,056	144 days, 8 hrs.	1,952,535	$ 92,678 93
1900	30-67/100	460,878	171 " 13 "	1,843,938	350,085 77
1901	20-30/100	258,250	104 " 13 "	2,420,288	142,273 41
1902	23-40/100	179,520	65 " 15 "	690,442	61,395 19
1903	17-48/100	127,083	53 " 7 "	373 000	44,943 70

By reference to Report for 1899 it will be noted that the season's operations were confined, mainly, to cleaning out the deposit of boulders and debris left in bottom of old Chinese workings, and the low grade deposits of gravel and volcanic mud lying on the rims north and west of said old workings, which accounts for the light product, in proportion to the quantity of water used.

The precipitation for season 1900 was $30\frac{67}{100}$ inches, and made, with the 100,000 inches carried over from 1900, 480,878 miner's inches of water available for use, a quantity exceeding the estimated holding capacity of the reservoirs, aggregating 470,370 miner's inches, as shown by the following table that accompanied the Hydrographic Map prepared in 1897.

TABLE OF WATER SUPPLY.

LOCALITY	WATERSHEDS AREA Sq. Ft Million.	AREA Acres.	AREA Sq. Mile.	RESERVOIRS DEPTH	TOP AREA Sq. Feet.	TOP AREA Acres	BOTTOM A SQUARE FT.	CONTENTS. Million Cu ft	CONTENTS. 24 Hr. Min. In.
Polley's Lake	337	7,736	12 09	8 ft.	40,660,000	933	35,400,000	304	140.741
Bootjack Lake	174	3,995	6.24	6 ft.	27,500,000	631	26,500,000	162	75,000
Main Ditch below Hazeltine	352	8,081	12 63						
Main Ditch above Hazeltine	155	3,558	5.56	33 ft.	27,000, 00	620	8,000,000	550	254,629
Dancing Bill	79	1,814	2 83						
Morehead Lake	460	10,560	16 50						
Little Lake above Morehead Ditch	99	2,273	3.55						
TOTALS	1,656	38,017	59.40			2,184		1,016	470,370
Little Lake below Morehead Ditch	95	2,180	3 41						

By reference to Annual Report for 1901, and Section No. 4 on the longitudinal section accompanying this report, it will be noted that the intrusion of an immense deposit of Slide Rock replaced a large area of high-grade gravel and reduced the average yield of the ground. This condition, together with the light precipitation and short water supply, accounts for the reduced product for that season.

The short water supply and inclusion of large deposits of slide rock in the Lower Bench, accounts for the light product for the seasons of 1902 and 1903.

The tables indicate that the gold product is dependent, mainly, upon

copious precipitation and a water supply ample to operate the mine full time with at least 2,500 miner's inches of water during the open season, including a period of about six months, commencing on or before May 1st, and ending on or about November 1st.

It is, therefore, evident that the precipitation must return to what it was prior to 1894, as reported by government agents and old settlers, varying each season, with few exceptions, from 30 to 40 inches annually, or the Company's catchment canals must be extended to control a much larger area of watershed, or to some stream affording an abundant and permanent flow of water throughout the open season. Surveys are now under way to determine the possibility and probable cost of extending the Company's system to a source that will insure an abundant and permanent water supply that will be ample to carry operations over seasons of light precipitation.

The heavy precipitation recorded for September ultimo, amounted to $6\frac{24}{100}$ inches, and caused the water in the storage reservoirs to rise as follows :—

Morehead Lake, rise 86 in., being now 13 in. lower than maximum height.
Polley's Lake, " 20 in., " 3 in. higher than for 1903.
Bootjack Lake, " 15 in., " 5 in. " " 1903.

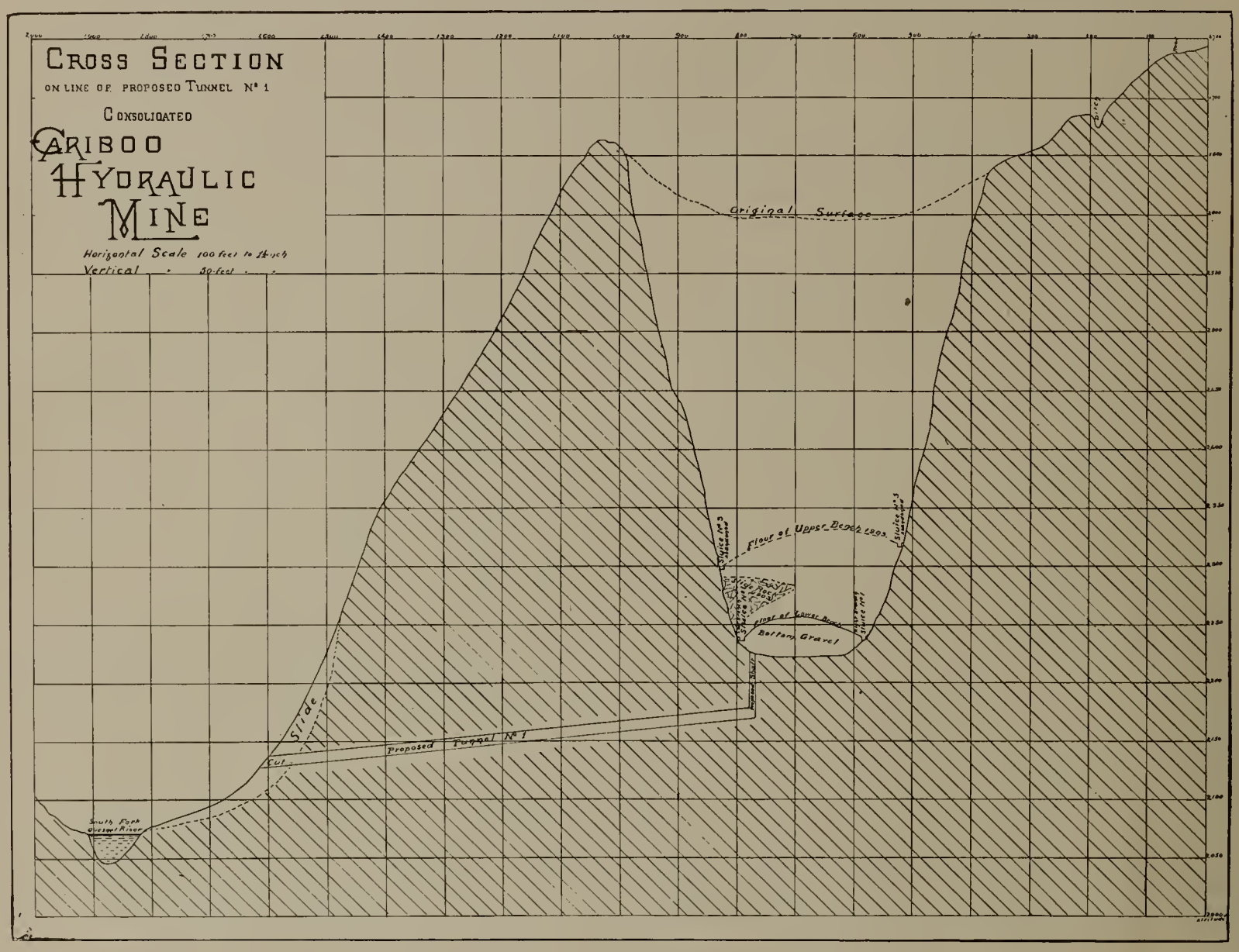
With so large a quantity of water on hand in the storage reservoirs the outlook is certainly favorable for a good water supply for the ensuing season.

CONDITION OF THE MINE.

To better illustrate the subject, I have prepared, and append hereto, a longitudinal section on line of workings, and a cross section on line of proposed sluice tunnel site No. 2.

By reference to the longitudinal section you will note that all the ground in the Third Bench, including sections Nos. 5 and 7, has been worked out up to the face of the Main Bank, leaving the shallow bench of ground between sluice No. 1 and bed-rock as Bench No. 4, extending from the point where sluice No. 1 goes above bed-rock at "A," about 1,110 feet to the face of the Main Bank.

Sections 1*a*, 1 *b*, and portion of 1 *c* were worked out by the Chinese, who reported a gold recovery of $900,000. The Cariboo Hydraulic Mining Companies worked out the remainder of Sections 1 *a*, 1 *b*, and 1 *c*, and recovered therefrom $128,000. The Cariboo Hydraulic Mining Company worked Section No. 2 and recovered therefrom gold valued at $400,000. The Consolidated Cariboo Hydraulic Mining Company worked Section No. 3 during season of 1900 and recovered therefrom $350,085.77. Section No. 4 was worked out in 1901 and produced $142,273.41. Sections No. 5 and 6 were worked out during season of 1902. Section No. 5 produced $35,395.19, and Section No. 6 produced $26,000.00, a total of $61,395.19. Sections Nos. 7



and 8 were washed during season of 1903. Section No. 7 produced $36,032.94, and Section No. 8 produced $8,910.76; a total of $44,943.70; making the total gold product for the 2,370 feet of channel worked, amount to $2,026,-698 07.

The bed-rock Cut "B," and Sluice Tunnel No. 1, at site No. 1, should have been completed during the season of 1900, so that all the ground included in Sections Nos. 4, 5, 6, 7 and 8 and the Fourth Bench, included in Section No. 6, could have been washed through sluice, cut and tunnel at reduced cost for mining and sluice maintenance, but the delay in the delivery of the power drill plant and electric appliances, until late in 1901, made it impossible to complete either cut or tunnel as expected.

The Sluice Tunnel must be driven, from either site No. 2 or site No. 3, during the season of 1904 to afford outlet to the dumps for the ground worked during season of 1905.

Since the Sluice Cut has been lowered and the branches of Sluice Section No. 1 have been carried up to the Main Bank, and the working face includes a greater depth of high-grade gravel than has been exposed for washing siuce the opening of the property, the mine is in better coudition for continuous and profitable operation than it was at the opening of the season of 1900, when $200,000.00 was netted out of a product of $350,085.77.

The outlook for the ensuing season's operations is, therefore, very favorable for a large output, at reduced cost, calculating, of course, on the precipitation being ample to afford a good season's water supply.

Imports of Mining Machinery during 1903.

The imports of free and dutiable mining and smelting machinery for the twelve months ending December 31st, 1903, are as follows :—

Months.	1903.			1902.		
	Free	Dutiable	Total	Free	Dutiable	Total
January	$ 77,298	$ 7,676	$ 84,974	$ 92 984	$ 2,549	$ 95,533
February	30,106	1,587	31,693	43,123	2,380	45,503
March	83,535	11,534	95,069	55,255	2,629	57,884
April	104,967	4,638	109,605	61,227	5,087	66,314
May	155,493	1,469	156,962	90,820	4,782	95,602
June	155,387	6,707	162,094	77,270	5,293	82,563
July	128,730	4,737	133,467	47,511	2,171	49,628
August	105,838	4,083	109 921	90,798	1,139	91,937
September	89,473	6,522	95,975	82,090	8,906	90,996
October	110,570	1,812	112 382	57,011	4,385	61,396
November	106,897	9,927	116,824	56,692	9 395	65,687
December	60,489	11,710	72,199	45,359	1,883	47,242
Total	1 208,783	72,402	1 281,185	799,740	51,599	851,339

The principal sources from which this machinery has been imported during 1903 :—

Months.	United States		Great Britain		Other Countries	Total
	Free	Dutiable	Free	Dutiable		
January	$ 75,235	$ 7,676	$ 417	—	$ 1,646	$ 84,974
February	29,467	1 587	639	—	Nil	31,693
March	82,680	11,534	158	—	697	95,069
April	104,902	4,638	65	—	Nil	109,605
May	155.127	1,293	366	206	"	156,992
June	152,517	6,579	2,034	128	836	161,084
July	105.899	—	13.756	4,737	9,075	133,467
August	100,942	3,119	4,756	964	140	109,921
September	82,941	6,086	5,640	416	882	95,965
October	90,790	1,641	19,761	171	19	112,382
November	104,702	9,498	2,195	429	Nil	116,824
December	55,902	11,710	4,587	—	"	72.199
Total	1 141.104	65,361	54,374	7,051	13,295	1 281,185

Mr. Harry E. Macdonnell, general freight agent of the Kootenay lines for the C.P.R made an important announcement recently which has been anxiously waited for by the mine owners of the Slocan for some time past. Mr. Macdonnell stated that the C.P.R. has decided to declare a rate of $13 per ton on zinc ores and zinc concentrates from the Slocan district to Antwerp. This rate covers shipments in bulk, and this will obviate the necessity for sacking concentrates at the shipping points. The rate hitherto in effect was considerably higher and the reduction will allow some ores which could not hitherto be sent to be now shipped at a profit.

The largest mass of virgin copper ever discovered was found in the old Minnesota mine, in Michigan, in 1856. It weighed 525 tons and required twenty miners a year and a half, working with long-handled chisels, to cut the huge mass into chunks small enough to be hoisted.

Imports of Wire Rope during 1903.

The following table shows the imports of wire rope and cables for the year ending December 31st, 1903.

Month.	From Great Britain		From U. S.		Total.	
	Pounds.	Value	Pounds	Value	Pounds	Value
January	115,646	$ 8,363	16,909	$ 2,210	132,555	$ 10 573
February	152,813	9,504	30,172	2,683	182,985	12,187
March	151,408	9,038	46,602	2,607	198,010	11,645
April	148,276	6,663	20,199	2,640	168,475	11,303
May	132,564	9,174	59,994	5,395	192,558	14,569
June	320,882	20,047	49 312	4,028	370,194	24,075
July	192 756	12,176	68,857	6,861	261,613	19,037
August	104,215	6,145	38,634	2 997	143,949	9,142
September	142,671	9,927	52,773	6,806	195,444	16,733
October	184,728	14,310	167,993	13,636	352,721	27,946
November	66,439	3,802	70,624	5,275	137,063	9,077
December	133,598	7,986	75,304	5,538	208,902	13,534
Imports from other countries					92,658	6,103
Total	1,847,096	$119,135	697 373	$60,676	2,637,127	$185,919

COMPANY NOTES.

The Tyee Copper Co.—The increasing output of the Tyee mine has rendered it necessary for the Company to enlarge the tram-line. In order to do this operations were suspended for a short time during the present month. The work was completed by the 16th inst., and the company now expect to ship 200 tons per day from the mine to E. & N. Railway, thence to be carried to the company's smelter at Ladysmith. Work at the mine itself progresses steadily, with increasingly satisfactory results, the property looking better than ever as development proceeds. The company's smelter at Ladysmith is in very satisfactory shape, ore coming in regularly in large quantities. A contract has been made, we are informed, with Mr. Vaughn-Rhys, the present lessee of the Van Anda mine, to ship the output of that property to Ladysmith. The contract will run for two years, and calls for some 15,000 tons of ore per annum. During the month of November the smelter ran for 29 days. A total of 6,340 tons of ore was smelted, giving a return of $65.735, after deduction of refining charges and amount paid for customs ores.

The Yreka Mine.—Among the satisfactory evidences of the progress the mining industry is making on the West Coast of Vancouver Island none is more gratifying than the announcement that the Yreka mine is again in a shipping condition. Operations at this property were seriously hindered during the past season by the scarcity of water. In addition to this, a large amount of work was necessary to place the mine in running order. This has now been accomplished to such an extent that shipping operations have been resumed, and a large additional force of men have been sent up to handle the increased output. At the commencement of the present month over five hundred tons of ore were on the dump ready for shipment. Mr. Nicholas Tregear, who has borne so conspicuous a part in the recent successful developments at the Lenora mine Mt. Sicker, went up to the Yreka in the latter part of November on behalf of his employers, the Northwestern Smelting and Refining Co., of Crofton, B.C., who are in control of the Yreka mine under a large contract, and who are making a great success on Quatsino Sound as they have done at Mt. Sicker. Mr. Tregear, on his return, expressed himself as extremely well satisfied with the work done and with the appearance and prospects of the property. The shipments now commenced will continue steadily for the future

The Blue Bird.—This mine in the Slocan District, near Sandon, B.C. has just shipped a car and when the gasoline engine is ready for hoisting another car will be hoisted and steady shipments from that on will be in order. The property is looking very well and the grade of ore is rich. They have a nice sample of ore ready for shipment at the C. P. R. Depot to the St. Louis exhibition weighing 520 lbs. and assaying 150 ounces in silver and 60 per cent. lead.

The Lucky Jim Group, Slocan District.—Mr. Hughes has taken a bond on the Lucky Jim group at Bear lake and has started a small crew at work. This property has not been worked for a number of years. The last time it

was worked it was for its zinc by a Manchester company. It is said to contain large bodies of zinc and is considered a very valuable mine for this alone. It also has some lead ore. It was one of the first shippers in the Slocan.

The Sunset Mine, Slocan.—The Sunset has started in to rawhide and there is already over 100 tons ready at the mine for shipment. They expect to ship about 500 tons this winter.

Le Roi.—Cable from the manager :—"Shipped from the mine to the Northport smelter during the past month 17,256 tons of ore, containing 5,428 oz. of gold, 6,665 oz. of silver, and 407,800 lb. of copper. Has resulted in an (estimated) loss of $15,500, according to the usual calculations. Development work, 1,350 level.—In reference to my cable, dated the 17th, have commenced a stope 30 ft. by 20 ft., with ore in top, bottom and sides; the grade of the ore varies between $10 and $20—not possible to estimate closely, owing to presence of small dyke. Other work 1,350 level encouraging; although have not yet met masses of ore, I consider we have justified expenditure involved." (Office note.—The above includes not only the costs of mining, smelting and realisation of the smelter products, but also $1.48 per ton of ore mined for depreciation and development. Mr. Parrish has already been requested in future cables to state separately the cost of development.)

Under date of January 12th, a Rossland despatch says :—Manager Parrish has at last made an authoritative statement regarding the strike on the 1,350 foot level of the Le Roi. This is the first time that an authoritative statement rgarding the strike has been made, after a studied silence of six months. Mr. Parrish declares that at a point 300 feet west of the main shaft and on the 1,350-foot level a crosscut has been run 100 feet along the course of the diamond drilling. Since encountering the ore body he has drifted fifty feet one way and thirty feet another, but as yet there is no sign of any end to the shoot. The ore is solid, and much samples run from $12 to $20 per ton. From time to time the assays run into big figures This places the new discovery well within the limit of first-class ore that will yield handsome profits—greater, in fact, than is customary in any of the big properties. But this is not all. At a point a considerable distance further west ano her crosscut on the same level has also encountered ore of similar grade to that found nearer the shaft. Mr. Parrish is not prepared just now to say whether this is a solid continuation of the first strike, but it may be, and the chances are that it is. If it is, then the biggest ore shoot ever discovered in the Rossland camp exists on the 1,350 foot level of the Le Roi. The new strike lies to the south side of the mine. The work on it at present consists of crosscutting and drifting. To better determine its extent a winze will be sunk and upraising will also be done. Attempts will also be made to prove the continuity of the ore body from the first to the second strike. Mr. Parrish was not prepared to say what he would do about proceeding with the work below the 1,350 foot level. He is concentrating his attention for the present upon the prospecting of the new find. Asked for an expression of opinion as to tne merits of the strike, Mr. Parrish said that it might be the top of as big an ore shoot as was ever found in the mine. The showing so far was satisfactory. If it is as he hopes, Mr. Parrish declares that there are great days of prosperity for the Le Roi.

The Canadian-American Coal and Coke Co.—Over fifty men are again on the pay-roll of the Canadian-American Coal & Coke Co., of Frank, and Manager S. W. Gebo expects to be taking out and shipping coal in quantity within the next few days. The business men of Frank are feeling more than hopeful as an era of prosperity again appears to be opening for that place. Manager Gebo will have personal chgrge of the works and this in itself is sufficient to inspire confidence in all who know both that property and Mr. Gebo that the work will be carried throngh to success and the property again made a big producer.—Blairmore *Times*.

The Arlington Mine.—The expenses for the month of December, 1903, at the Arlington mine (Erie) amounted to $4,134 62. Shipments were resumed commencing on December 19th, and 90 tons of ore shipped up to the 31st. The returns for these 90 tons will pay the month's expenses, but the payments were not received until January, so will appear in the statement for that month.

Crow's Nest Pass Coal Co.—Mr. T. R. Stockett has been appointed general manager of the Crow's Nest Pass Coal Co.'s mines for a period of three months, and Mr. G. G. S. Lindsey, K.C., the Toronto counsel for the company, has been appointed managing director, while Mr. D. Davies has been confirmed in the position of comptroller.

Payne Consolidated Mining Co.—A despatch from Sandon, B.C., dated Jan. 19, says :—Mr. Jones of the Lanyon Zinz works, Iola, Kansas, has bought the zinc from the Payne. He is reported to have bought 1000 tons. It has all to be shipped within the next thirty days. The price paid has not been divulged, but it is generally understood that he paid more for it than he was paying last year. Mr. Jones has also bought about 300 tons of zinc ore from Phil Hickey of the Ivanhoe, this is now being loaded.

NEW COMPANIES.

ONTARIO.

The Corundum Refiners, Limited.—Incorporated under the Statutes of Ontario, 27th November, 1903. Authorized capital, $1,000,000, in 10,000 shares of one hundred dollars ($100) each. Directors: J N. Scatcherd, C. R. Huntley, J. A. Roberts, J. H. Tilden, J. C. Conway, H. H. Dewart, W. Vandusen, H. H. Coburn, W. B. Rankine, J. H. Jewell. Head office: Toronto, Ont. Formed to acquire the properties known as "The Corundum Refiners, Limited."

The Northern Light Mining and Development Company, Limited.—Incorporated under the Statutes of Ontario, 9th December, 1903. Authorized capital, $1,000,000, in 1,000,000 shares of one dollar ($1.00) eoch. Directors: J. Gonska, J. H. Hill, G. Collatz, W. Fawcett, N Mueller, C. Larson, J J. Durage. Head office: Port Arthur, Ont. Formed to acquire the properties known as "The Northern Light Mining and Development Company, Limited."

Ontario Lead and Zinc Company, Limited.—Incorporated under the Statutes of Ontario 16th December, 1903. Authorized capital, $600,000, in 600 000 shares of one dollar ($1.00) each. Directors: E. C. Kennedy J. A. MacIntosh, A. R. Clute. Head office: Port Arthur, Ontario. Formed to acquire the properties known as the "Ontario Lead and Zinc Company, Limited."

The Anglo-American Oil Company, Limited.—Incorporated under the Statutes of Ontario, 18th December, 1903. Authorized capital, $100,000, in 1,000 shares of one hundred dollars ($100) each. Directors: W. McIntosh, J. A. McIntosh, S. A. Holbrook, Rose Lessler, D. S. Robb, J. C. Winters, J. M. Prophet. Head office: Chatham, Ont. Formed to acquire the properties known as "The Anglo-American Oil Company, Limited."

Lindsay Portland Cement Company, Limited.—Incorporated under the Statutes of Ontario, 18th December, 1903. Authorized capital, $500,000, in 50,000 shares of ($10) each. Directors: J. D Flavelle, T. Sadler, R. Sylvester, J. B. Knowlson, J. M Squier, R. Kennedy, A. Ross, T. Stewart. Head office: Lindsay, Ont. Formed to acquire the properties known as the "Lindsay Portland Cement Company, Limited."

BRITISH COLUMBIA.

The Bridge River and Lillooet Gold Milling Co., "Limited Liability"—Re-incorporated and registered under the Statutes of British Columbia, 23rd December, 1903. Authorized capital, $750,000 in 750,000 shares of one dollar ($1) each. Formed to acquire the properties known as "The Bridge River and Lillooet Gold Mining Company, Limited."

The Zala Consolidated, Limited, "Non-Personal Liability."—Re-incorporated under the Statutes of British Columbia, 21st December, 1903. Authorized capital, $600,000 in 1,200,000 shares of fifty (50) cents each. Formed to acquire the properties known as "The Zala Mines, Limited," "Non.Personal Liability."

The Fraser River Coal Company, Limited, "Non-Personal Liability."—Incorporated uoder the Statutes of British Columbia, 28th December, 1903. Authorized capital, $10,000, in 100,000 shares of ten (10) cents each. Formed to acquire the properties known as "The Fraser River Coal Company, Limited," "Non-Personal Liability."

Hardscrabble Hydraulic Gold Mines, Limited,, "Non-Personal Liability."—Incorporated under the Statutes of British Columbia, 28th December, 1903.—Authorized capital, $90,000 in 3,000,000 shares of three (3) cents each Formed to acquire the properties known as the "Hardscrabble Hydraulic Gold Mines, Limited," Non-Personal Liability."

The Richmond Oil Company, Limited.—Incorporated under the Statutes of British Columbia, 12th January, 1904. Authorized capital, $12,000 in 1,200 shares of ten dollars ($10) each. Formed to acquire the properties known as "The Richmond Oil Company, Limited."

The International Gold Company.—Registered under the Statutes of British Columbia, 12th January, 1904, as an Extra-Provincial Company. Authorized capital, $15,000 in 1,500,000 shares of one (1) cent each. Head Office, City of Whatcom, State of Washington, U.S.A. Head Office in this Province. Vancover, B.C., J. C. Martin. Vancouver, B.C., Attorney. Formed to acquire the properties known as "The International Gold Company."

CONCENTRATES.

The following table gives in long tons, actual copper production of the various countries of the world, for the year 1902, with estimates of 1903 outputs. As the final figures will not be secured for six months in some cases, the table must be taken merely for what it purports, which is to be a reasonably close estimate of 1903 production, based upon the best data available at the close of 1903 :

Country.	1903.	1902.
United States	318,861	303,446
Spain and Portugal	51,000	49.790
Mexico	48,000	35,785
Chile	30,000	28,130
Japan	31,000	29,775
Germany	22,000	21,605
Canada	22,500	17,485
Australasia	29,000	28,640
Peru	7,500	7,580
Russia	8,000	8 000
Cape Colony	4,500	4,450
Norway	5,000	4,565
Italy	3,500	3,370
Miscellaneous	8,500	7,895
Total	589,361	551,316

The Boundary B.C. ore shipments for the second week in the new year are almost exactly the same as for the first week, namely, a little over 16,000 tons. The several shipping mines sent out the following amounts to the different smelters :

Granby mines, to Granby	10,680
Mother Lode, to Greenwood	3,840
Emma, to Granby	750
Senator, to Granby	120
Oro Denoro, to Granby	570
Athelstan, to Granby and Greenwood	330
Total for the week	16,290

The total tonnage for the year to date is 32,560. This week the Granby smelter treated 12,441 tons of ore, making a total of 33,850 tons for the year.

The Slocan "Drill" reports the ore shipments from that district during the year 1903 to be 1,339 tons, as compared with 6,333 tons during the previous year. The decrease is due to the suspension of operations at the Arlington and the changed conditions at the Enterprise. In 1902 the former shipped 3,797 tons, and the latter 2,300, while for last year the figures were 40 and 915 tons respectively. The following is a list of the shipments for the past year:

Mine.	Tons.
Enterprise	915
Arlington	40
Ottawa	146
Black Prince	67
Bondholder	2
Dayton	12
Republic	70
Meteor	52
Hamilton	4
Westmont	2
Highland Light	2
Alberta	3
Cripple Stick	2
Nansen	2
Hampton	5
Sapphire	5
Kilo	10

The ore shipments from the Rossland district, B.C. for the week ending Jany. 16th, 1904, were: Le Roi 6,900, Centre Star 1,380, War Eagle 1,260, Kootenay 215, Jumbo 350, Le Roi No. 2 600, Le Roi No. 2 (milled) 220, Spitzee 30. The week's total was 10,955 tons, and for the year to date, 22,098 tons.

The importation of Old Country French miners at Lille has proved anything but a success. as they have been a source of more trouble to the management than any other class of miners employed. This has always proved true of imported men, who unaccustomed to the customs of the country, foreign in speech and unused to the mining methods employed, soon become homesick and discontented.

Figures are given showing the production of coal in the five principal coal-producing nations in 1902, as compared with 1901, as follows:—United Kingdom, 227,095,000 tons, increase, 8,048,000 tons; United States, 268,688,000 tons, increase 6,814,000; Germany, 107,436,000 tons, decrease 1,103,000; France, 29.574,000 tons, decrease 2,060,000; Belgium, 22,769,000 tons, increase 556,000. The total known production of the world is stated to be about 700,000,000 tons.

The Rossland *Miner's* annual review of the year's operation in that camp states that the revision of tonnage figures gives an aggregate for the year of 377,134 tons, estimated to have a gross value of $4,631,280. During the ten year's of the camp's history 1,687,768 tons of ore have been produced, having an estimated value of $26,816,342. The camp has enjoyed a most prosperous year and notable strides have been accomplished in connection with the mining industry. The increase in tonnage is approximately 50,000 tons over last year. A notable feature was the inauguration of concentration and its successful application. The Le Roi No 2 plant is now treating at a profit ores carrying net values in excess of $5.50, and the margin will be substantially lowered in the larger plants now in course of construction.

IN THE HIGH COURT OF JUSTICE.

MERCHANTS BANK OF CANADA vs. STEWART et al.

JUDICIAL SALE

OF

Canadian Anthracite Coal Company Stock

PURSUANT to a Judgment and Order for Sale of this Court, made in this action, tenders will be received by William Louis Scott, Esquire, Local Master of this Court at Ottawa, at his office in the Court House in the City of Ottawa up till 12 o'clock noon on WEDNESDAY the 16th day of MARCH next (1904) for **755** fully paid up **shares** of the par value of $100 00 each in the Capital Stock of **The Canadian Anthracite Coal Company, Limited,** (a body corporate, incorporated by Letters Patent of the Dominion of Canada). The Company's mines are situated near Calgary in the Northwest Territories of Canada.

Tenders may be made for the whole 755 shares or for any smaller number thereof.

Tenders must be sealed and addressed "W. L. Scott, Esq., Local Master, Court House, Ottawa, Canada," and marked "Merchants Bank vs. Stewart, Tender for shares", and each tender must be accompanied by a certified cheque payable to The Merchants Bank of Canada, for not less than ten per cent of the amount of such tender. Such cheque will be returned in the event of the tender not being accepted.

Upon the acceptance of any tender the balance of the purchase money shall be paid into Court to the credit of this action within thirty days thereafter and the purchaser shall thereupon be entitled to a transfer of the shares covered by his tender. In the event of the purchaser failing to pay the said balance of the purchase money the deposit of ten per cent above mentioned shall be forfeited and the shares may be re-sold and any deficiency thereon shall be made good by the defaulter.

The purchaser will prepare the transfer of shares at his own expense and will tender the same for execution and all expenses incidental to the investigation of title and the registration of the transfer shall be borne by the purchaser.

The highest or any tender will not necessarily be accepted.

Further particulars may be had from Messrs. Wyld & Osler, Messrs. Gemmill & May, Messrs. Lewis & Smellie, Messrs. Murphy & Fisher, Messrs. MacCracken, Henderson & McDougal, Messrs Gorman & O'Connor, Messrs. Christie, Greene & Hill Messrs. Hogg & Magee, Messrs Nellis, Monk & Matheson, Messrs. McLaurin & Millar, and Messrs. Gormully & Orde, Barristers, Ottawa; and Mr. Adam Johnston, Barrister, Morrisburg, Ont.
Dated at Ottawa the 6th day of January, A D. 1904.

(Sgd.) W. L. SCOTT,
Master at Ottawa.

Gormully & Orde,
33 Sparks Street, Ottawa,
Vendors' Solicitors.

Canadian Mining Institute

INCORPORATED BY ACT OF PARLIAMENT 1898

AIMS AND OBJECTS.

(A) To promote the Arts and Sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications.

(B) The establishment of a central reference library and a headquarters for the purpose of this organisation.

(C) To take concerted action upon such matters as effect the mining and metallurgical industries of the Dominion of Canada.

(D) To encourage and promote these industries by all lawful and honourable means.

MEMBERSHIP.

MEMBERS shall be persons engaged in the direction and operation of mines and metallurgical works mining engineers, geologists, metallurgists, or chemists, and such other persons as the Council may see fit to elect.

STUDENT MEMBERS shall include persons who are qualifying themselves for the profession of mining or metallurgical engineering, students in pure and applied science in any technical school in the Dominion, and such other persons, up to the age of 25 years, who shall be engaged as apprentices or assistants in mining, metallurgical or geological work, or who may desire to participate in the benefits of the meetings, library and publications of the Institute. Student Members shall be eligible for election as Members after the age of 25 years.

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PUBLICATIONS.

Vol. I, 1898, 66 pp., out of print.
Vol. II, 1899, 285 pp., bound red cloth.
Vol. III, 1900, 270 pp., " "
Vol. IV, 1901, 333 pp., " "
Vol. V, 1902, 700 pp., " "
Vol. VI, 1903, 600 pp., now in press.

Membership in the Canadian Mining Institute is open to everyone interested in promoting the profession and industry of mining without qualification or restrictions.

Forms of application for membership, and copies of the Journal of the Institute, etc., may be obtained upon application to

B. T. A. BELL, Secretary,
Orme's Hall, Ottawa

The Mining School at Camborne, Cornwall, England, owns a mine known as the King England, which is under the management of the teaching staff. From 100 to 125 students get an opportunity to work underground two days in the week, the remainder of their time being occupied by studies at the school itself. It is claimed that this is the only mining school which owns and works a mine.

At the Bendigo mine, Australia, (the deepest gold mine in the world), the main shaft is down 3,900 feet. At the 3,856-foot level a cross-cut is being driven for one of the rich saddles in which high values have been found. In this the temperature of the rock has been found to be 108 degrees F. Three men are required to work a rock drill at this depth, and in order to keep them cool, the men at the face are sprayed with water.

Public Companies Record in 1903.

LIQUIDATIONS AND RECONSTRUCTIONS.

From the Somerset House returns of companies winding up, either voluntarily or by order of the Court, and reconstructions during last year, we find reference to the following Canadian and American undertakings :

VOLUNTARY LIQUIDATION.

North-West Ontario Mining and Development Co.
Vancouver Land and Securities Co.
Clifton Tinto Copper Mines.
Canadian and British Columbia Prospecting Syndicate.
Doric Gold Mines.
British Columbia Financial Trust and General Corporation.
Anglo-Canadian Gold Estates.
McDonald's Bonanza (Klondike).
Utah Consolidated Gold Mines.
Sultana Mine of Canada.
Copper King.
Clifton Consolidated Copper Mines of Arizona.
British Mexican Syndicate.
Klondike Development Co.
British Canadian Timber and Manufacturing Co.
Anglo-Alaskan Syndicate.
Pacific North-West Mining Corporation.

RECONSTRUCTION.

Rossland Proprietary and Mining Co.
Columbia Hydraulic Mining Co.
Anglo-Wyoming Oilfields.
Mikado Gold Mining Co.
London and British Columbia Goldfields.
Backman Mines.
Diaz Mines.

COMPULSORY LIQUIDATION.

Sapphire Corundum Co.
Anglo- Canadian Produce Co.

SALE OF VALUABLE MICA MINE
IN CANADA

PURSUANT to the Order of the High Court of Justice, for the winding up of the Wakefield Mica Company, there will be offered for sale by public auction at the Local Master's Office, in the Court House, in the City of Ottawa, in the Dominion of Canada, on the

17th DAY OF MAY, 1904, at 2.30 P.M.

1. All the mines, minerals and mining rights in and upon Lot No. 16 in the 2nd Range of the Township of Wakefield in the County of Wright in the Province of Quebec, containing 200 acres, with the buildings erected thereon for mining purposes.

2. Water power and mill privilege on Blackburn's Creek on said Lot, containing one acre in fee simple, with saw-mill thereon erected, and electric dynamo and other machinery therein, including auxiliary steam plant.

3. All wood and timber on Lot No. 16 B in the 3rd Range of said Township, with free right to cut and remove same up to the 29th day of October, 1916.

4. A large quantity of mining plant and machinery, consisting of electric pump, motors belting, shafting, derricks, drills, blacksmith's tools, rope, piping, telephones, stoves, cutlery &c.

The property is situate about six miles from Wakefield Station on the O.N. & W.Ry., and about 20 miles from the City of Hull. A shaft has been sunk to a depth of 170 feet and a considerable amount of mica has been extracted therefrom. Specimens of the mica and a detailed inventory of the chattels, a report of an independent Mining Engineer, and other information may be obtained from the Liquidator.

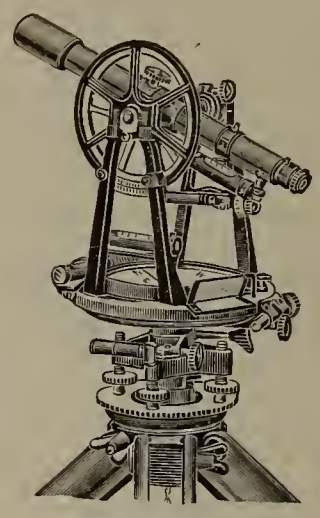
The entire property will be sold in one block, subject to a reserved bid fixed by the Master.

Ten per cent of the purchase money must be paid at the time of sale, and the balance within 30 days.

Dated the 21st day of January 1904.

ERNEST A. LARMONTH,
Liquidator,
48 Elgin Street, Ottawa, Canada.

W. L. SCOTT,
Local Master at Ottawa.



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F. E. CANDA, President. C. J. CANDA, Vice-President. F. MORA CANDA, Secretary. T. I. JONES, Treasurer.

DOMINION OF CANADA

SYNOPSIS OF REGULATIONS

For Disposal of Minerals on Dominion Lands in Manitoba, the North-West Territories, and the Yukon Territory.

COAL.

Coal lands may be purchased at $10.00 per acre for soft coal, and $20.00 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at such rate as may from time to time be specified by Order-in-Council shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding Free Miner's certificates may obtain entry for a mining location.

A Free Miner's Certificate is granted for one or more years, not exceeding five, upon payment in advance of $10.00 per annum for an individual, and from $50.00 to $100.00 per annum for a company, according to capital.

A Free Miner having discovered mineral in place may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end of the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a Mining Recorder's Office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.00.

At least $100.00 must be expended on the claim each year or paid to the Mining Recorder in lieu thereof. When $500.00 has been expended or paid the locator may, upon having a survey made and upon complying with other requirements, purchase the land at $1.00 per acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of royalty on the sales not exceeding five per cent.

PLACER MINING, MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

Placer mining claims generally are 100 feet square; entry fee, $5.00, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

DREDGING IN THE RIVERS OF MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

A Free Miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental $10.00 per annum for each mile of river leased. Royalty at the rate of two and a half per cent., collected on the output after it exceeds $10,000.00.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the rivers below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100.00 per mile for first year, and $10.00 per mile for each subsequent year. Royalty ten per cent on the output in excess of $15,000.00.

PLACER MINING IN THE YUKON TERRITORY.

Creek, Gulch, River, and Hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other Placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end bearing notices. Entry must be obtained within ten days if the claim is within ten miles of Mining Recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a Free Miner's certificate.

The discoverer of a new mine is entitled to a claim 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee $15.00. Royalty at the rate of 2½ per cent. on the value of the gold shipped from the Territory to be paid to the Comptroller.

No Free Miner shall receive a grant of more than one mining claim on each separate river, creek, or gulch, but the same miner may hold any number of claims by purchase, and Free Miners may work their claims in partnership, by filing notice and paying fee of $2.00. A claim may be abandoned and another obtained on the same creek, gulch, or river, by giving notice, and paying a fee.

Work must be done on a claim each year to the value of at least $200.00, or in lieu of work payment may be made to the Mining Recorder each year for the first three years of $200.00, and after that $400.00 for each year.

A certificate that work has been done or fee paid must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a Free Miner.

The boundaries of a claim may be defined absolutely by having a survey made, and publishing notices in the *Yukon Official Gazette*.

HYDRAULIC MINING, YUKON TERRITORY.

Locations suitable for hydraulic mining, having a frontage of from one to five miles, and a depth of one mile or more, may be leased for twenty years, provided the ground has been prospected by the applicant or his agent; is found to be unsuitable for placer mining; and does not include within its boundaries any mining claims already granted. A rental of $150.00 for each mile of frontage, at the rate of 2½ per cent. on the value of the gold shipped from the Territory. Operations must be commenced within one year from the date of the lease, and not less than $5,000.00 must be expended annually. The lease excludes all base metals, quartz, and coal, and provides for the withdrawal of unoperated land for agricultural or building purposes.

PETROLEUM.

All unappropriated Dominion Lands shall, after the first of July, 1901, be open to prospecting for petroleum. Should the prospector discover oil in paying quantities he may acquire 640 acres of available land, including and surrounding his discovery, at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by Order in Council

JAMES A. SMART,

Deputy of the Minister of the Interior.

OTTAWA, 9th Dec., 1901.

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The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental – such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

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GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents anuually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

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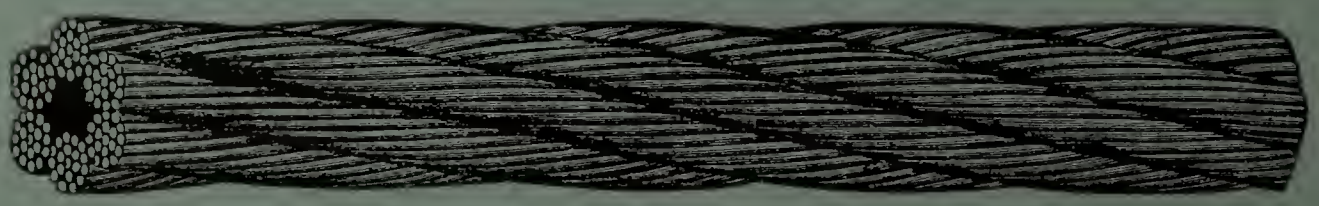

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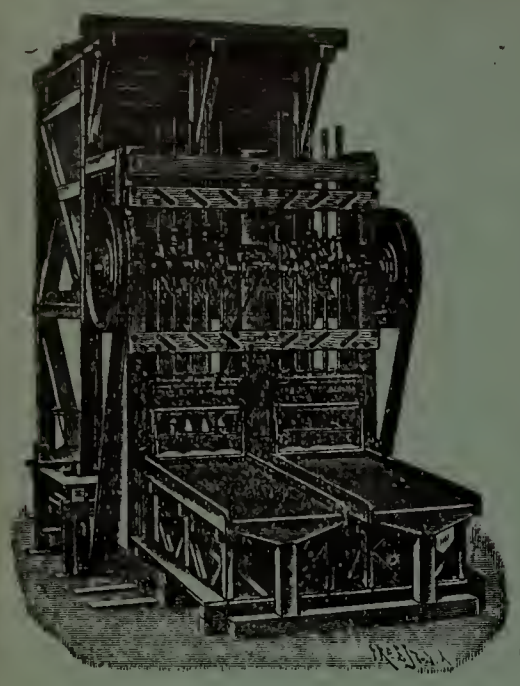

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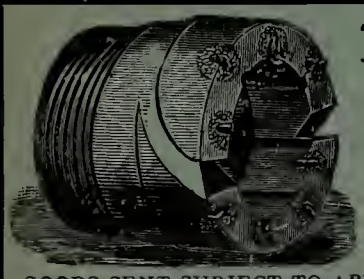

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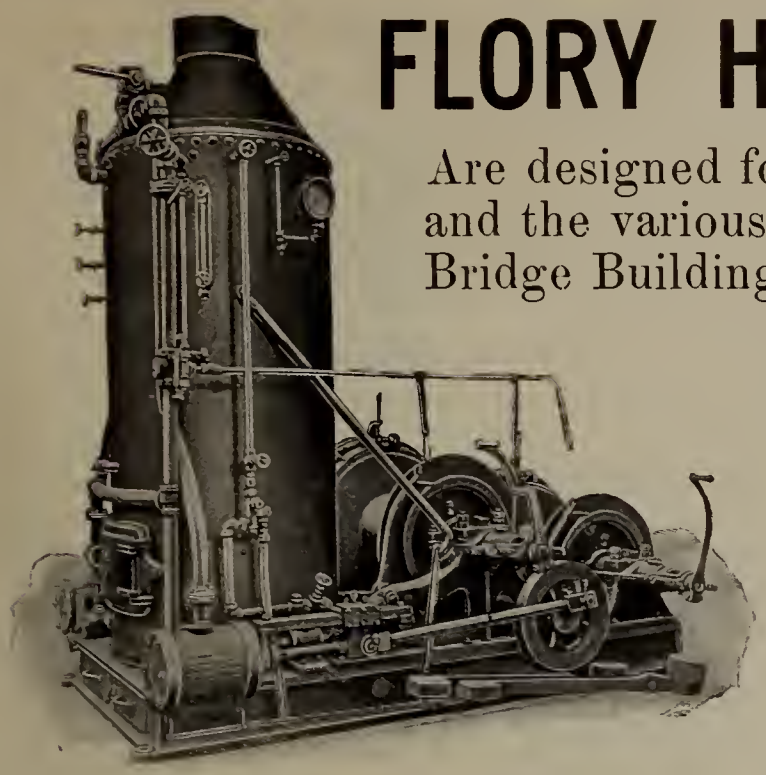

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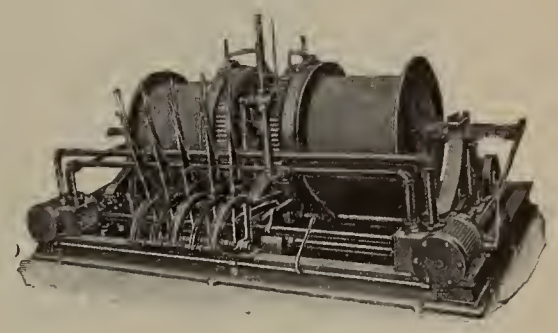

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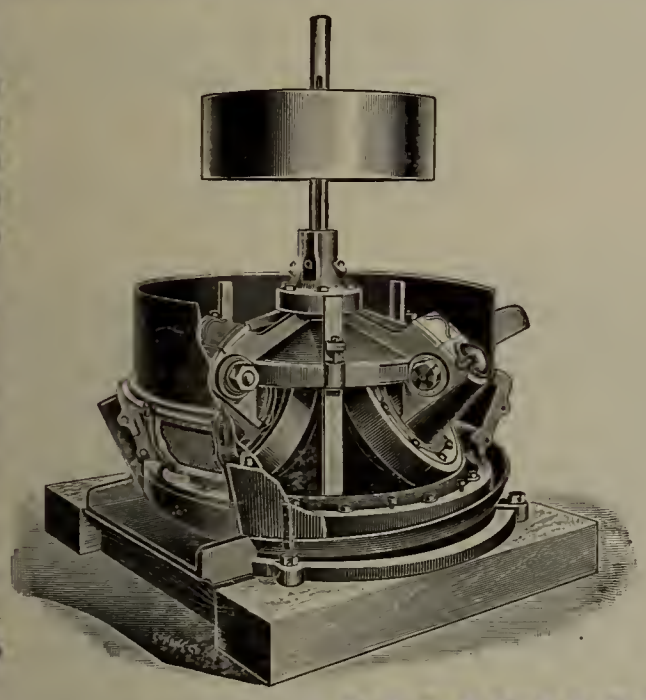

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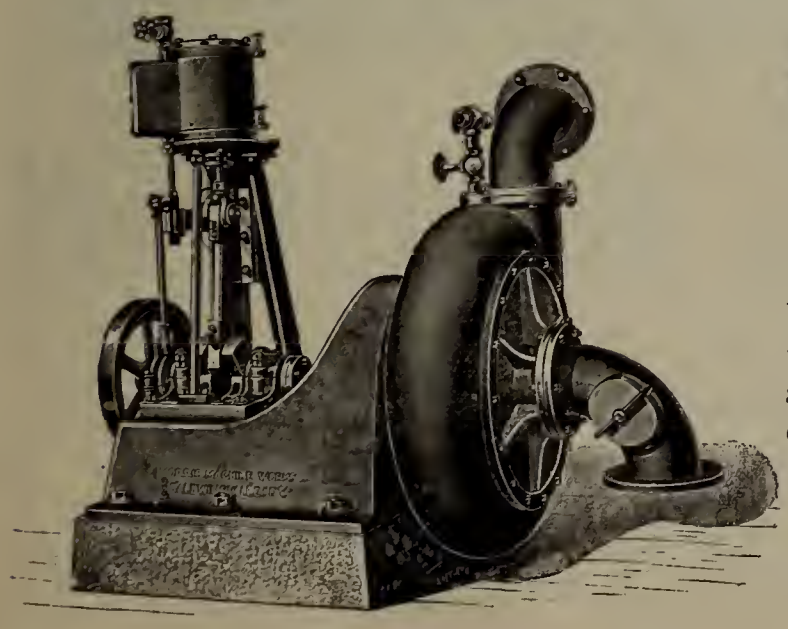

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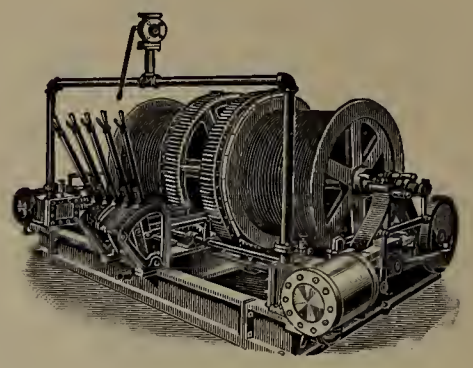

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SPECIAL ATTENTION GIVEN TO MINERS' REQUIREMENTS

The B. Greening Wire Co. Limited

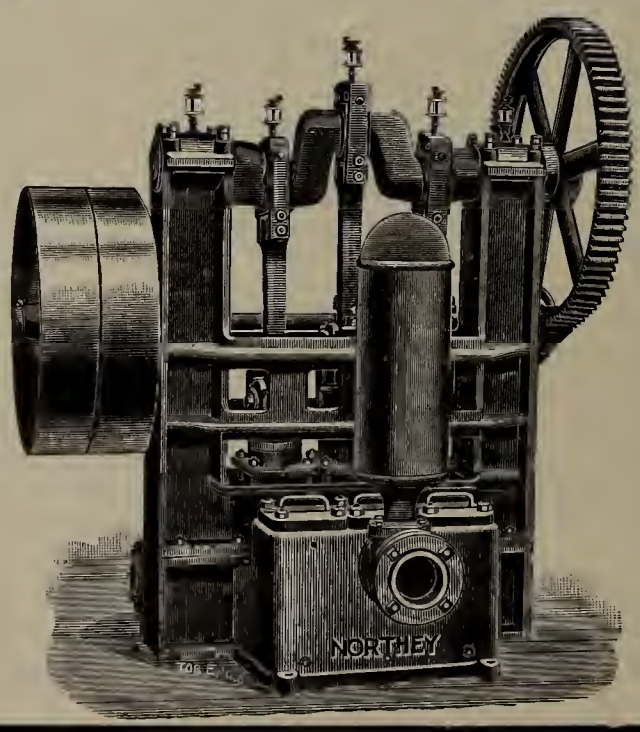
HAMILTON, ONT. MONTREAL, QUE.

Pumps for Mine Work

Triplex Power Pump . . . . . .

We are manufacturing headquarters for all classes of Pumping Machinery. We have been in this business for a great many years and have given special attention to the construction of Mine Pumps. We are prepared to quote on Station Pumps; Pumps for bad Mine water; Pumps actuated by Electricity, Compressed Air or Steam; Sinking Pumps or Pumps for any special duty.

Catalogues, Plans and Specifications furnished on request.



We illustrate in this advertisement a typical Pump for Mine Work. This is our Triplex Power Pump, fitted with tight and loose pulleys as shown in cut. It is the regular Triplex type with the three cranks 120 degrees apart; crankshaft and connecting rods are of steel; gears machine-cut from the solid; plungers of brass and all details carefully worked out. This Pump is especially adapted for service with Electricity as the motor power.

THE NORTHEY CO., Limited, Toronto, Ont.

22nd YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING AND ENGINEERING JOURNAL PUBLISHED IN THE DOMINION OF CANADA.

B. T. A. BELL, Editor and Proprietor.
Secretary, Canadian Mining Institute, etc.

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Joint Stock Corporations Law.

The year of grace 1903 saw the collapse of many balloons which had been duly inflated by the methods of the Charter Mills established under various Governments here and elsewhere. And with the balloons fell many ballonists, an Earl or two, a Countess and other titled ladies, Knights a many of various orders, judges, clerics and laymen of high and low degree. Some went hence as suicides, others to hide their dimmed social lustre by change of abode, many to battle anew on life's billowy sea against wind and wave and tide and current hindering them from the desired haven. From how many have gone out any word to warn others of the doom which follows every effort to essay the empty air with wings not given to mortals? Has any, indeed, lifted up voice or pen to denounce the laws which afford facilities for cunning, and furnish plans and methods for the gamesters who exploit the mingled cupidity and ignorance of mankind?

"Under existing laws, it is possible for the president and directors of a company to play all sorts of tricks for their personal advantage," says one writer. President Roosevelt has asked the American people to adopt measures for their protection against crimes of cunning as effective as those in force for the suppression of crimes of violence. One has not far to seek the reason for a state of the law which meets with such wide condemnation. It is found in the concurrent effort of heads of State Departments to make their offices sources of public revenue, and of brokers to remove from the Statute Book any check against the facilities for flotation which they might find a hindrance to reckless business operations. It is on record that one reason advanced for certain amendments of a Joint Stock Companies' Act was that a certain Department was not getting a proper share of patronage from applicants for Charters. And it is also well known that the Mining Companies' Act of Ontario was in some measure the creation of stock brokers possessed of the notion that mining capital is most easily attracted by the offer of nominally paid up shares at a discount.

Mr. John Brisben Walker, in *The Cosmopolitan* for last January has pithily stated the causes of the scandalous state of Corporation law in the United States in terms quite applicable to the Dominion of Canada and some of its Provinces. "The Statutes," he writes, "have grown up by chance under local requirements. They have been framed in a large measure to meet special interests." "There has been no broad or disinterested intelligence used in preparing the Statutes authorizing incorporation. The public has not been safeguarded."

All this and more has been told the members of the Canadian Mining Institute and the readers of the MINING REVIEW. The difficulty of obtaining capital for legitimate mining enterprises has become so great through lack of public confidence, due as much to mismanagement of company affairs as of mine affairs, that it is simply impossible for the large majority of people of average intelligence to believe that if they take shares in a Joint Stock Mining Company their money will be honestly invested, prudently managed, and truthfully accounted for. Because, as Mr. Walker states the fact, "there is no requirement by Statute compelling the issue of stock upon a basis which will give to investors an approximately exact idea of the property represented by the stock" and "there is no uniform requirement which will give stockholders a full, complete and fairly stated idea of their property at the close of each year."

What is the remedy Mr. Walker proposes for this evil? It is not cause for surprise that it is precisely what is needed under our own national system:—"A National incorporation law with registration at the Department of Commerce and annual reports placed on file for the examination of the business."

The hope that a uniform system of mercantile law would extend from the Atlantic to the Pacific was not unknown to the fathers of Confederation. The class-interests of the legal profession may in some degree be opposed to this consummation. But while "the incorporation of Companies with Provincial objects" is assigned to the jurisdiction of local legislatures, it is indisputable that the gain to the community by the adoption of a uniform corporation law would stimulate enterprise to an extent in which the lawyer would find his advantage equally with the banker and the merchant. The Department of Trade and Commerce would find a new and most useful function which with the aid of a system of Inspection would render the operation of a well devised code of Stock Corporation Law, of incalculable benefit to the country.

The transfer to the Federal Department of Trade and Commerce of the granting of franchises to Joint Stock Corporations would obviously require the amendment of the British North America Act, and of necessity the consent of the Provinces. The revenue from the Provincial Charter Mills is considerable, and would certainly not be surrendered without an equivalent. There might be an arrangement to transfer the fees for charters to the provinces in which the Head Offices would lie, less some proportion for administration expenses Any plan by which the system of joint-stock incorporation could be elevated in public regard would be followed by an enormous increase of business. The facility with which banking enterprises are stocked is in some measure due to public confidence in Dominion legislation,

while the immense increase in the capital of banking and life insurance enterprises, is evidence that there is no lack of money in the country where security is offered the investor. To systematize the incorporation of joint-stock enterprises on a basis affording to the shareholders a degree of scrutiny they are in too many cases unable to give, would commit to limbo many concerns not worthy of incorporation, and while thus protecting the community would afford to legitimate enterprises the advantage of removing from competition those adventures whose perennial failures discredit more or less meritorious enterprises entitled to confidence. The great cause of co-operation would by a wisely administered federal law for the incorporation of joint-stock companies receive a great impetus in every direction of legitimate enterprise. Will the country arise to meet this demand of the hour?

The Value of the Mining Engineer to the Mining Investor.

The report of mining successes is inevitably followed by mining investment. Where money has been made, more may be made. A dividend-paying mine always occasions the purchase of an adjoining property, reputed to have an extension of the vein, and sometimes a whole district is bought up on the strength of one rich spot. The stories that have come from South Africa, Western Australia, Cripple Creek, Cariboo, Rossland, Boundary, Eastern Ontario, Nova Scotia and other localities where mining is and has been profitably pursued have revived an interest in the mining industry as an investment. As there is every indication of a revival of mining investment in Canada, it may be well to endeavor to give some counsel to those who may be solicited to put their spare cash into mines. And first we would say to all such, do not spurn the request as a temptation of Satan and treat the proposal with scorn. But rather give it a serious consideration for two good reasons, one of which is that there are certainly great prizes to be had in mining, and the other is that such investment is one of the best ways of benefitting a country. Do not say as did a multi-millionaire the other day, when solicited to put a small sum into a legitimate and promising mining operation, "I would rather take the money and throw it into the ocean, then I should know it was gone, and have done with it; but if I put it into a mine I should lie awake nights and worry about it." There was perhaps some excuse for this good man's petulance, for his office was adorned with a large frame containing very ornamental share certificates of defunct mining companies.

As to prizes in mining, many examples have been furnished during the last twenty years in British Columbia, Nova Scotia, Quebec, and more recently in Ontario. Prospects that were bought from needy explorers at prices ranging from $100 to $1,000 have been sold for large figures, and again the investors in these mines are receiving dividends from the mineral production. Mines are not all swindles or mere holes in the ground to sink money in. They are frequently good, and when they are are good they are often very good. Ore deposits that on the surface only yielded $4 or $5 a ton, upon being followed to a depth, have increased in value to $50 or $60 a ton and have paid handsome profits. New districts are being opened to which railway transportation will soon be given, and by development are sure in some localities to show rich pay centres that will make the fortune of the lucky investor, or else will prove to be of so good an average that, considering the cheapness of mining and treating large masses of ore, the profits will be great and steady.

As to benefits to the country, we can hardly expect either patriotism or utility to have much influence in deciding an investment. Yet it may have its weight with some minds, and such should understand that money put into mines probably moves a more varied and larger number of industries than any other investment. Every amount expended upon mineral production is divided among a multiplicity of interests, for a mine as a rule involves the creation of a little village of its own, and in the opening of the mine and the winning, transport and treatment of the ore a wonderfully diversified demand is made upon the other branches of production and industry. Mining investment has a good mental effect, and ought to be recommended as a tonic and stimulant for invalids. It is intensely interesting and gives a wide range to the thoughts and opens up enquiry about localities and methods of work that are both entertaining and instructive, and when the telegram comes that the pay steak has been struck and high assays secured, and that the vein has widened with depth, the excitement is so pleasurable that it is as good as a dividend in itself for its effect upon the happy investor.

The greatest difficulty, however, in mining investment is to decide what is a good venture, and it is on this point that we aim to give some advice to our capitalistic friends. There is no doubt that they have been woefully bitten by glib-tongued promoters, who, coming with all the romance of the wild and wooly west about them, effectually pull the wool over the confiding investor's eyes Even when they have gone to visit the mine personally they have been equally deceived. After a wearisome journey and the discomforts of log cabin bunks and miners' grub, they toil up the tortuous trail or scramble through the thick underbrush until, when the spot is reached where the treasure is said to be, they are too exhausted to investigate properly, and too disgusted to feel any interest. They willingly accept the representations of others rather than make further effort to examine for themselves. Or if they go into the tunnel or descend the the shaft, with eyes scarcely able to peer through the grim darkness, they see nothing but moist, black rock, until the well instructed and wily pit foreman strikes with his pick and hands up a glittering piece of ore, and then another, saying with each stroke, "It is here-and here-and here," until the visitor thinks the whole face of the tunnel is solid ore, whereas it may only have a few streaks that the miner knows just where to strike. Or if the visitor selects samples himself they may be salted. A man was recently met in the wilds of British Columbia looking for a gold mine to put a stamp mill on. He had a mill brought in 150 miles from a railway, but had no mine to employ it. Enquiring as to how so singular a thing happened, he said that he went to examine a mine and was particular to select all the samples of quartz with his own hands, but he incautiously laid the specimens down on the ground, and when his back was turned a man adroitly sprinkled some flour gold over them. The assays went so high that the mine was bought and the machinery ordered, but at last one of the men got faint-hearted and "blowed" on his partner, and new assays of rock proved the mine to be worthless. These stories are common enough, and are only alluded to in order to show how difficult it is for one, who has not the special experience needed for judging, to determine the value of the proposed investment. A novice will not venture to buy flour or grain without the inspector's certificate, yet men will buy mines or mining shares on the merest impulse or the recommendation of strangers, or else will venture upon their own judgment, which has not been trained to the work in view and is therefore valueless. The lesson to be taught is the value of expert testimony—the importance of consulting the men who know about such matters as much as can be known—for it must be admitted that a good deal is necessarily unknown about a mine and the practical miner often sneers at his skilled professional brother by saying, "One man can see into the ground as far as another." But this remark is not correct, for some men can see a long way into the ground, or at any rate can discern that there is hardly a chance of there being any value out of visual sight. The maxim we

would impress upon the investor is, look at the men, not at the mines. Consider that you are probably incompetent to judge of a mine by personal examination and that you must necessarily be at the mercy of some one. Mining investment is largely a matter of confidence; that is the bother of it. But being so, it behooves one to be wary whom he confides in. If a man high in his profession, of good repute and known to have been successful in his undertakings, offers an investment, let it be carefully considered, and give such an one a decided preference over the unskilled promoter who retails his hearsay stories into your ear. It is easy to find reliable men, of skill and experience in mining, and we advise intending investors to seek them out and profit by their counsels.

The Carbides.

Ever since Wohler in 1862 made calcium carbide and showed that it formed acetylene when put into water, the possibilities of this and other carbides as substances of industrial importance might have been expected to emerge at any time. Wohler's method of making the substance, viz;—by heating calcium-zinc alloy with charcoal, was altogether to expensive for a commercial process, and the same statement is true of later methods, until Willson, in 1893, hit upon the process now in use. It is to be noted that Moissan made calcium carbide in his electrical furnace in 1892. The history of this subject is fruitful. It illustrates a fact often exemplified, namely; the preparation, which the study of pure science makes for industrial applications. The patient research of men who have no thought of making money by their discoveries, usually precedes, and indeed essentially, in most cases, the discovery of the process which finally brings into the market a new substance, a new machine, or perhaps a new luxury. The work of the earlier investigators does not make as much stir in the world. The world in general does not see its usefulness; and it is our object just now to point out what has already been done in the manufacture of compounds of industrial importance like calcium carbide, and to indicate some others already obtained on a small scale and perhaps likely to be used industrially in the future.

The possibility of making on an industrial scale this interesting class of substances was realized through the invention of the electrical furnace, which in the hands of men like Cowles, Willson, Moissan, Acheson, Hall, Heroult, and many others has worked such wonders in metallurgy as well as in the field which we are now investigating; but the furnace itself would have been useless without cheap electricity, which we owe to the labours of a succession of able men beginning with the purely theoretical work of Faraday and coming down to the perfect generators of to-day. The use of water power has been the final stage in this cheapening of the current; and in a country like this where water power is so widespread and easily available, it behoves us to study carefully the results of investigations. however theoretical they may seem, which deal with the manufacture in the electrical furnace, of substances like the carbides. Let us take stock of what has already been done. Almost contemporaneously we have Willson's discovery of the commercial manufacture of calcium carbide, and Acheson's equally interesting process of making silicon carbide or carborundum. The former has assumed an importance which could hardly have been anticipated at the time of its discovery. In countries where water-power is available, calcium carbide is now being made for the manufacture of acetylene gas, the use of which is extending rapidly. In fact this industry can now boast of having several journals devoted solely to its literature. Most of these are of course published in Germany. Carborundum is now manufactured on a large scale, and used extensively, not only as an abrasive but also in the metallurgy of iron and steel, as a convenient and very pure form in which the necessary carbon and silicon may be added to the iron. It thus so far displaces ferro-silicon in the market. Of the 3¾ millions of lbs. of carborundum made in 1902, nearly half was used for this purpose. Other uses have also been found for calcium carbide, viz.—as a reducing agent for some of the metals, L. M. Bullier has lately used it in conjunction with common salt and similar materials to convert iron into steel. Considering the advances which have been made in these two substances during the ten years since they were first put on the market we are encouraged to look for industrial uses for the numerous other carbides, which have been made chiefly by Moissan. To show how rapidly events move in this region, we need only take up some of the books of a few years back dealing with this subject in which we find statements like this:—"Carbides. We have very little information regarding this class of compounds" (Watt's Dictionary 1888). Some half dozen carbides are mentioned, but the list does not include calcium carbide, although that substance was known at that time. In Thorpe's *Dictionary of Applied Chemistry* published in 1890, calcium carbide is not even mentioned. This was only 13 years ago; and, indeed, only seven years later, Moissan published a volume of 385 pages (Le Four Electrique Par M. Henri Moissan, De L'Institut; Paris, G. Stinheil, Editeur) dealing with the electrical furnace, and the carbides and other substances which he has been able to make by its means. A short review of this work of Moissan will not be out of place here. After a description of the electrical furnace, he discusses the formation of artificial crystals of lime, strontia, baryta, magnesia, aluminna, the oxides of chromium manganese, iron, nickel, and cobalt. It is to be noted that the artificial crystals of alumina are identical with the natural corundum (not to be confused with carborundum). It would be opportune here to point out a curious slip in the Chairman's address for 1903 before the Canadian Section of the *Society of Chemical Industry* (Journal No. 9 Vol. XXII.) He writes "although deposits of corundum itself are found in Eastern Ontario, the artificial carbon silicide has practically supplanted the natural product as an abrasive agent." When we recall that only about 875 tons of carborundum (Carbon Silicide) were used as an abrasive in 1902, and that Ontario alone produced 1100 tons of corundum in that same year, it is easily seen how misleading the statement of the learned Chairman is. It is quite possible indeed that carborundum (with its misleading name) will extend its use in steel-making more rapidly than as an abrasive, although its qualities for the latter purpose are unquestionably very fine. The works at Niagara Falls find a ready market for their whole output.

But "to return to our muttons", viz:—Moissan.

The experiments on the crystallisation of the oxides of metals were carried out at a temperature of about 2,000° centigrade. In the following section the author describes his success in distilling a number of the metals, including copper, silver, platinum, aluminum, tin, gold, manganese, iron and uranium. He also succeeded in volatilising silicon, boron, and even carbon. Chapter 2 deals with the different varieties of carbon. His experiments lead the way to the artificial manufacture of graphite, lately carried out with such success in the graphitisation of carbon electrodes. The Chapter is closed by an account of his crowning triumph, the production of artificial diamonds, by the sudden cooling of iron highly charged with carbon. This was effected, as is well known, by plunging the molten iron into molten lead. In Chapter 3 the author gives an account of the reduction of chromium, manganese, molybdenum, tungsten, uranium, vanadium ,and several other interesting metals of the rarer sort. Chapter 4 is devoted to the study of carbides and the similar compounds called silicides and borides. In addition to calcium carbide, Moissan has been able to

prepare up to this date, carbides of the similar metals, barium and strontium, lithium, cerium and other metals of that group, also carbides of aluminum, zirconium, chromium, molybdenum, tungsten, vanadium, manganese, and uranium. One of the most interesting carbides obtained by Moissan was titanium carbide (Ti C) which he made by the use of an electric arc of 1,000 amperes and 70 volts, acting on a mixture of titanic acid (160 parts) and carbon (70 parts) in the Moissan electric furnace. The action was complete in ten minutes and the new compound was obtained in part distinctly crystalised, with a density of 4.25.

The most interesting property of these crystals is their extreme hardness. Moissan found that they would scratch diamonds even, the first substance so far obtained hard enough to do this. This may eventually become a very important discovery. The two constituents titanium and carbon are very plentiful in Canada. There is abundance of iron ore containing as high as 20 or 30% of titanium. Another titanium mineral, sphene or titanite, is comparatively abundant in some of the counties of Ontario, particularly in North Renfrew. Is it too much to hope that methods will be discovered of bringing together these two elements titanium and carbon in such a way as to produce on a successful commercial scale crystals of titanium carbide for use as an abrasive, and, particularly, large enough to replace the diamond in such operations as drilling? When we consider the history of calcium carbide, of carborundum, and of artificial graphite, we may with some degree of confidence look forward to the time when titanium carbide wili have taken its place as one of the commercial products of the electrical furnace.

EN PASSANT.

The many friends of Mr. B. T. A. Bell, editor and proprietor of the REVIEW, will regret to learn that as we go to press, he is lying dangerously ill at his residence, in consequence of a severe accident which occurred to him on the morning of the 18th instant. The details of Mr. Bell's mishap will be found below, in the published account which was given in the Ottawa "Evening Citizen" of the same date. Mr. Bell's injuries are of such a severe character that it is impossible for anyone to see him, with the exception of certain members of his immediate family, and at present his attending physicians are not in a position to do more than conjecture, as to the chances of his early recovery. The accident could not possibly have happened at a more unfortunate period for Mr. Bell, as he was busily engaged in a number of important matters apart from his editorial duties. His time had been more than fully occupied in the preparation of his report on the evidence submitted before Judge Britton and himself, while members of the Yukon Commission in connection with the Treadgold Hydraulic Concessions. In addition to this the labor involved in his duties as Secretary to the Canadian Mining Institute and in superintending the numberless details in connection with its annual convention, in Toronto, on the 2nd, 3rd and 4th March next, was very heavy and exacting. Under these conditions those who know, and are familiar with Mr. Bell's personality, will readily understand that his progress towards convalescence will necessarily be slow, as the knowledge he has, that the work in which he was engaged, when so suddenly and shockingly interrupted, is largely at a standstill, will not be conducive to that mental repose which is so necessary a condition to an early recovery in a case of this kind. The staff of the REVIEW, join with the many kind friends who have shown their sympathy, by telegrams, letters and personal inquiries; in the sincere hope that our genial and esteemed chief may in a short time, once more be found filling the editoral chair with his accustomed vigour and cheerfulness.

"About 10.30 yesterday morning, Mr. B. T. A. Bell, editor and proprietor of the Canadian Mining Review, was seriously injured by falling down the elevator shaft in Orme's music store, Sparks Street. Tenants of the Orme block, facing on Wellington Street, where Mr. Bell's office is situated, have been in the habit of securing entrance by a short cut through the Sparks Street store, from which a door leads on to the alleyway running between the two blocks. Instead of proceeding by way of this door, Mr. Bell opened the door, also in the rear of the Sparks Street store, leading into the elevator shaft. The machine was at an upper floor at the time, and hence he fell to the basement, a distance of ten feet. He landed on the the concrete floor, on his right side, sustaining injuries to his head and shoulder. Dr. J. F. Kidd, O'Connor Street, was summoned, and he had Mr. Bell removed to St. Luke's Hospital.

Dr. Geo. MacCarthy, his brother-in-law, speaking of Mr. Bell's condition, said: "His chances of recovery are fair, but all depends on what complications, if any, set in. His strength is keeping up well. We are not certain yet whether his skull is fractured or not, but there are injuries to the base of the skull. It will be impossible for a day or so, to say what the outcome will be. It all depends as to whether or not inflammation sets in at the seat of injury. If it does not, then the patient's chances of recovery will be better. There is also a fracture of the collar bone, but all depends on the injuries to his head."

At a late hour last night Dr. MacCarthy said: "I am more hopeful of Mr. Bell's recovery than I was earlier in the day. He recovered consciousness for a few hours but complained of pain. For the greater part of the time he is in a comatose condition. There is no great discharge from the ear and this is a hopeful sign. There is no indication of compression, but it is impossible as yet to say anything of the outcome."

Mr. Bell's friends are hoping that his vigorous constitution will pull him through, but the fact is not lost sight of that the injury to the base of the skull is a very serious one."

In view of the part played by his firm in the defence of Mr. Whitaker Wright, the following quotation from Sir George Lewis's article in a London paper is interesting:—

I have been asked by the Editor whether I think that fraud has on the whole increased in the City during the past twenty years, and whether the tendency is for it to increase further. I fear I can only answer "yes" to both these questions. It seems to me that fraud has been, and is, on the steady increase, both in volume and in scope. As the law tightens its grip, so the dishonest rascal exercises greater ingenuity in his methods, and the result in the end is the same—the surplus money of many fools slides into the pockets of one wily and unscrupulous individual: There is an old Yankee saw which says that a man who steals a nickel is a thief, but the man who steals a million dollars is a genius. Many of the huge fortunes which have been amassed by mushroom "financiers" and promoters during the past decade have been built up on foundations of trickery, deceit and fraud, and if we examine the methods employed we find them little different from those of the racecourse thimble-rigger.

Says the *Engineering and Mining Journal*: The number of blast-furnaces reported in operation on February 1 showed a remarkable increase over that on January 1. The total weekly capacity of the active furnaces on February 1 was 287,700 tons of pig iron. This is 92,100 tons more than at the opening of the year, and is the highest capacity reported since October 1, 1903. The increase is chiefly due to the starting up of a number of furnaces by the United States Steel Corporation near the end of January, when it became apparent that

the reduction of output in December had been greater than was really warranted by the conditions. This seems to be proved by the fact that unsold stocks showed a small decrease, falling from 689,000 to 681,000 tons during January. In the basis of the February statement, our blast-furnaces are now making pig iron at the rate of about 15,000,000 tons per year. This is less than last year's output, but still promises a very respectable production. The total make of iron in January was about 970,000 tons; in February it will not be far from 1,050,000 tons.

The exports from Cape Colony, South Africa of the products of the mine for the ten months ending 31st October, 1903, as compared with the same period in 1902 are stated by the "Cape of Good Hope Government" to be as follows:

	1903.	1902.
Gold	£4,381,000	£ 9,643,000
Diamonds	4,293,000	4,641,000
Copper Ore	171,000	345,000
Total	£8,845,000	£14,629,000

Being a falling off in value of £5,784,000, principally due to the difficulty at present existing in securing a sufficient supply of unskilled labor.

A recent editorial in the *Canadian Manufacturer* has the following respecting the production of crude petroleum in Ontario at the present time:

The Imperial Oil Company's petroleum refinery at Sarnia, Ont., is said to be running at less than one-half its capacity, being unable to obtain crude oil to keep the plant in full operation. The Canadian production is going down, and the duty of five cents a gallon on the American oil is prohibitive, as it cannot be brought in and refined in Canada at a profit. It is claimed that the industry is in a serious position, and that the only relief which will be effective is to admit oil from the United States by reducing the duty to two cents a gallon. Advocates of this measure say that the Canadian oil will still find a market, as it will cost the refiners about twenty cents a barrel less than the imported crude oil. The consumer will get the benefit of the lower price of Canadian refined oil, about one cent a gallon, on the extra production of the Canadian refineries. The capacity of the Sarnia refinery is 780,000 barrels a year and of the Petrolea refinery 96,000 barrels. At the present proportion of 54 per cent. of refined oil from 100 per cent. of crude, this would call for 1,600,000 barrels of crude oil annually. The Canadian production for 1903 is estimated to have been 483,500 barrels.

Regulations for the payment of bounties on lead contained in ores mined in Canada have been approved of by the Dominion Government on the recommendation of the Department of Trade and Commerce. It is provided that the smelting of ores is to be under the supervision af an officer of the department, who can at any time demand and receive a portion of the floor sample of any ore delivered at the smelter for smelting purposes. All claims for bounty are to be substantiated by oath of the manager of the smelter works, and verified and certified to by a departmental officer. The cost of supervision must be born by the claimants.

A recent despatch from Vancouver states,—"Acting on behalf of the Yukon territorial government, A. J. Beaudette, Yukon government engineer, is here from Dawson, and will proceed to California, where he will make a study of the latest methods of hydraulic mining. His information will be utilized by the territorial government on his return, for the benefit of the mining community of the Yukon. He will also look into the best practice of modern installations of stamp mills and of recovery of values from free milling ores by amalgamation and concentration." Mr. Beaudette is well known to many in the East and is one of the latest additions to the membership of the Canadian Mining Institute.

The Canadian Mining Institute.

REPORT OF COUNCIL, 1903.

The Council takes pleasure in submitting the following brief review of the work and status of the Institute during the year 1903:—

MEMBERSHIP.

The following statement shows the membership by provinces and countries as at 31st December, 1903, compared with the same period in each year since the organization of the Institute:—

—	1898	1899	1900	1901	1902	1003
Nova Scotia	16	16	19	27	31	30
New Brunswick	2	1	2	2	1	1
Quebec	66	77	77	77	79	69
Ontario	44	68	91	83	107	108
British Columbia	42	65	72	67	72	68
Manitoba	..	..	..	..	2	2
Newfoundland	..	1	2	2	2	2
Alberta	5	5	5	6	6	7
Yukon	..	..	..	2	5	11
Great Britain	4	9	7	12	14	12
United States	11	17	26	30	36	36
China	..	1	1	1	..	..
Hawaii Islands	..	1	..	..	1	1
Spain	..	1	2	2	1	1
Australia	..	..	..	..	1	1
Tasmania	..	..	..	..	..	1
South Africa	..	..	3	4	..	..
East Africa	..	..	..	1	1	1
Alaska	..	..	1	..	..	1
Mexico	..	..	1	1	1	3
Labrador	..	..	..	1	..	..
South America	..	..	..	1	1	2
Students	2	15	14	12	92	78
	192	277	323	331	453	435
Died during the year	2	4	4	4	2	3

The Council reports with profound sorrow the deaths of Mr. James Cooper, of Montreal, Col. King, Sherbrooke, and Mr. John McAree, D.L.S., of Toronto. Owing to the fluctuations of the mining business and removal from the country a number of resignations go into effect at this meeting, but it is confidently anticipated that the number of new members to be elected will more than compensate for these losses.

LIBRARY AND READING ROOM.

The premises occupied by the Institute in Room IV, Windsor Hotel, Montreal, having become too small for the proper accommodation and growing requirements of our library, the Council, at a special meeting called for the purpose, decided by a vote of 19 to 3 to remove the collection to Ottawa, where it now is under the personal supervision of the secretary.

The new premises in Orme's Hall, Wellington Street, Ottawa, are most conveniently located and, as will be seen from the accompanying photographs, are large enough for the purposes of the Institute for many years to come.

By this change a saving of $100 per annum is effected in rent.

Members may now obtain a loan of any work of reference in this collection for a limited period by giving a receipt and surety

THE CANADIAN MINING INSTITUTE.

Library and Reading Room, Orme's Hall, Ottawa.—From photo showing portion of Book Cases.

Library and Reading Room, Orme's Hall, Ottawa.—View looking East.

THE CANADIAN MINING INSTITUTE.

Library and Reading Room, Orme's Hall, Ottawa.—View looking West.

Library and Reading Room, Orme's Hall, Ottawa.—From photo of a portion of Book Cases.

for the value of the book or books so loaned. Already this system has been taken advantage of by a number of members. A new catalogue is being prepared for the printer and will be distributed among the members when completed.

MEETINGS.

The Annual meetings were held at Montreal on the 4th, 5th and 6th March, 1903, and were exceedingly well attended. The proposal to hold a joint meeting with the Lake Superior Mining Institute at Sault Ste. Marie, in September, was abandoned in consequence of the unsettled condition of the mining and metallurgical industries of that district. Several meetings of Council and special committees were held in Montreal and Toronto.

A meeting of the Eastern Ontario section was held in Kingston in November and a number of interesting subjects discussed.

PUBLICATIONS.

The papers read before the British Columbia meetings held at Nelson in September, 1902, and at the annual meetings in March last year, some thirty in all, constituting the contents of Volume VI of the Journal of the Institute, were, unfortunately, destroyed by fire in June on the eve of the completion of the volume. Owing to delay in the re-equipment of the contractors' printing plant and the the Secretary's absence, first in the Yukon and later in Great Britain, the work of resetting the lost volume was not begun until his return early in December, but, by dint of hard work, it has been completed and will be in the hands of the members on or about the date of our annual meetings. In order to meet the increasing demand for our publications a larger edition has been struck off.

Several hundred copies of each of the papers by Messrs. MacDonald, Miller, Hille, Coste and Robinson were printed in pamphlet form and distributed during the year.

A revised List of Members containing the Charter and By-Laws of the Institute was also printed and distributed among the members.

At the close of the year the Secretary compiled and printed in pamphlet form a very complete and handily arranged volume of Indices to the authors and papers read before the Institutue and its antecedent organizations from 1891 to the end of 1903. This useful little volume, which has also been incorporated in the Journal for 1803, is now tabled for your inspection.

PROPOSED CHEMICAL AND METALLURGICAL SECTION.

Arising out of the admirable suggestions contained in the paper presented by Mr. W. Dixon Craig at our last annual meeting circulars have been issued, not only to our own members, but to many other Canadian chemists and metallurgists, with the object of bringing to a focus the question of organizing a Chemical and Metallurgical Section. Such an organization can accomplish much, not only for Canadian chemistry and metallurgy, but for mining and its associated industries. A meeting for the purposes of promoting this organization will be held on Thursday afternoon, 3rd March.

STUDENTS' COMPETITION.

Nine papers were submitted by Student Members. The Committee of Award in the Geological Section (Messrs. Goodwin, Adams and Walker), recommended that the cash prize of twenty-five dollars be given to Mr. S. H. Boright for his paper "On the Geology of the Northern Portion of the Boisdale Hills Anticline." In the Mining Division the Committee (Messrs. Hardman and Coste), recommended that Mr. Norman W. Parlee be given a similar cash prize for his paper on "Rock Drilling and Blasting." None of the papers being deemed to have sufficient merit to warrant its award, the President's gold medal was not given.

MINING STATISTICS.

The importance and necessity for greater uniformity in the compilation and publication of official mining statistics by the Provincial and Dominion Governments, was prominently discussed at our last annual meeting and the question referred to a committee, which has held several meetings. Their report will be submitted for your consideration.

FINANCES.

The audited Statement of the Treasurer, which will be submitted to you in detail at the annual meeting, shows a cash balance on hand of $2,912.73. This unusually large balance is, of course, largely due to the fact that the publication of Volume VI was, owing to the fire, not issued during the year. The following statement shows the receipts and disbursements from the organization of the Institute to the end of our last financial year, i.e., 31st January, 1904 :—

	Receipts.	Disbursements.
1898.....	$2,674 67	$2,454 85
1899	3,421 10	3,156 05
1900	3,601 50	3,455 76
1901	4,076 50	3,749 71
1902	6,330 89	5,655 80
1903	7,743 79	4,831 06

Submitted on behalf of the Council.

EUGENE COSTE, *President.* B. T. A. BELL, *Secretary.*

On the Manufacture of Sulphuric Acid at Sydney, C.B.

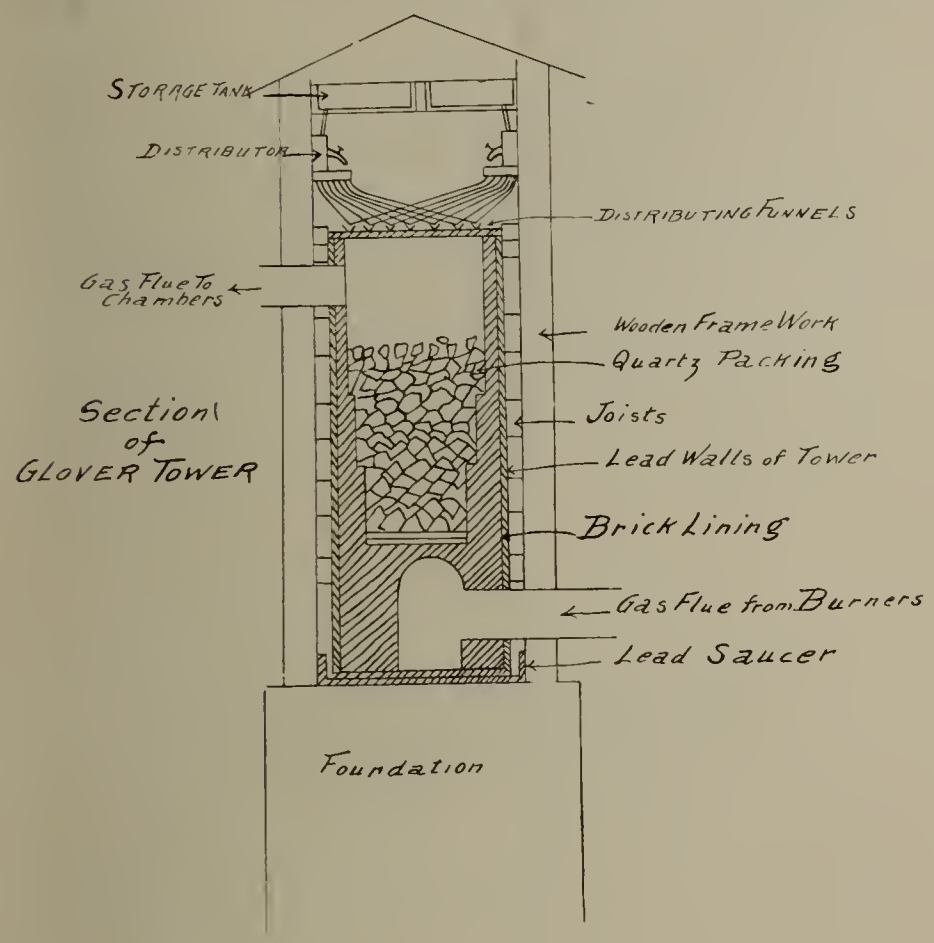
By C. A. MEISSNER, Sydney, Cape Breton.

(Continued from January issue.)

Gay-Lussac's invention consists of a leaden tower called after his name, and constructed on very similar lines to the Glover tower. It is generally made considerably higher than the Glover tower, say from 40 to 50 ft., and is given either a square or a circular cross section. Its capacity is usually proportioned according to the size of the chambers, 1 p.c. of the capacity of the latter being a very frequent proportion, though an increase to 2 p.c. secures a very much more efficient scrubbing of the gas and a recovery of the nitrogen acids. In some cases, the interior of the tower is lined with brick, whilst in others no lining is used. The usual packing for the tower is coke. Ordinary gas coke is of no use, only the hardest burnt oven coke, giving a clear ring and as little porous as possible, of a silvery white, not of a dull black color. A third of the tower is filled with large pieces of the coke about a foot or so in length, then some pieces next in size, and for the last third smaller lumps may be used, but nothing which will go through a riddle with three inch holes should be allowed to go into the tower. The tower is covered in, in the same way as the Glover tower, and is provided with a distributing table and storage tank.

The principle on which this tower acts depends on the fact that strong sulphuric acid of 60° Be', possesses the property of absorbing nitrous acid when brought into contact with it, forming nitro sulphuric acid, or the nitrous vitriol of the trade. It will be remembered that the acid obtained from the base of the Glover tower is strong, of 60° Be', and has been deprived of its nitrous acid. This is in a fit state to be used in the Gay-Lussac tower, to the top of which it is pumped and allowed to run down through it. This liquid meets the ascending gases and absorbs the nitrous acid contained in them, running out at the base of the tower as nitrous vitriol, available for use over again in

the Glover tower, where the nitrous acid is restored to the process. It will thus be seen that the two towers act one with the other, the one absorbing the nitrous acid gas from the gases leaving the chambers, the other restoring it to the fresh gas entering the chambers, so that there is a constant interchange going on. The waste gases which reach the top of the Gay-Lussac tower should consist, theoretically, entirely of air. In practice, however, small traces of sulphur and nitrogen acid gases are always present, though, it is possible to keep them down to a very low amount. In Great Britain the Alkali Act prescribes that the escaping gases from the end of the process shall not contain more than four grains of acids calculated as sulphuric acid in a cubic foot. In practice it is quite possible to keep the acidity of the escape below this limit. At the end of the process is fitted the arrangement for producing the draft, which causes the gases to pass regularly from the burners to the Gay-Lussac tower. This may consist of a steam jet introduced into the exit pipe from the top of the



tower, or else the exit pipe is carried down to the base of a tall chimney stack where a damper is placed to control the sucking action of the stack.

In a room at the base of the towers are placed the tanks for receiving the acids running from the towers, and the pumping arrangements for raising the acids to the top of the towers.

The successful and efficient working of the process depends very much on the regularity with which every operation, such as charging the pyrites and nitrate of soda, testing the drips around the chambers, running the acids down the towers, and controlling the draft is observed.

The manner in which the waste product from the nitre oven is disposed of has been mentioned.

The other waste product is the cinder from the the roasted pyrites called purple ore. In case this contains copper in paying quantities, 4 p.c. or above, it is usually shipped to the copper smelters for the extraction of that metal. When roasting copper ores it is usual to mix them with salt, which converts the copper into chlorides, but can be leached out with slightly acidulated waters, and the subsequently precip ted copper smelted. The purple ore from copper ores after leaching is very free from sulphur, and in that way makes a very good blast furnace ore. The reason ores containing copper are more free from sulphur after roasting is because the copper oxide formed during the roasting reacts on the copper sulphide, according to the formula:

$$2\,CuO + Cu_2S = 4\,Cu + SO_2.$$

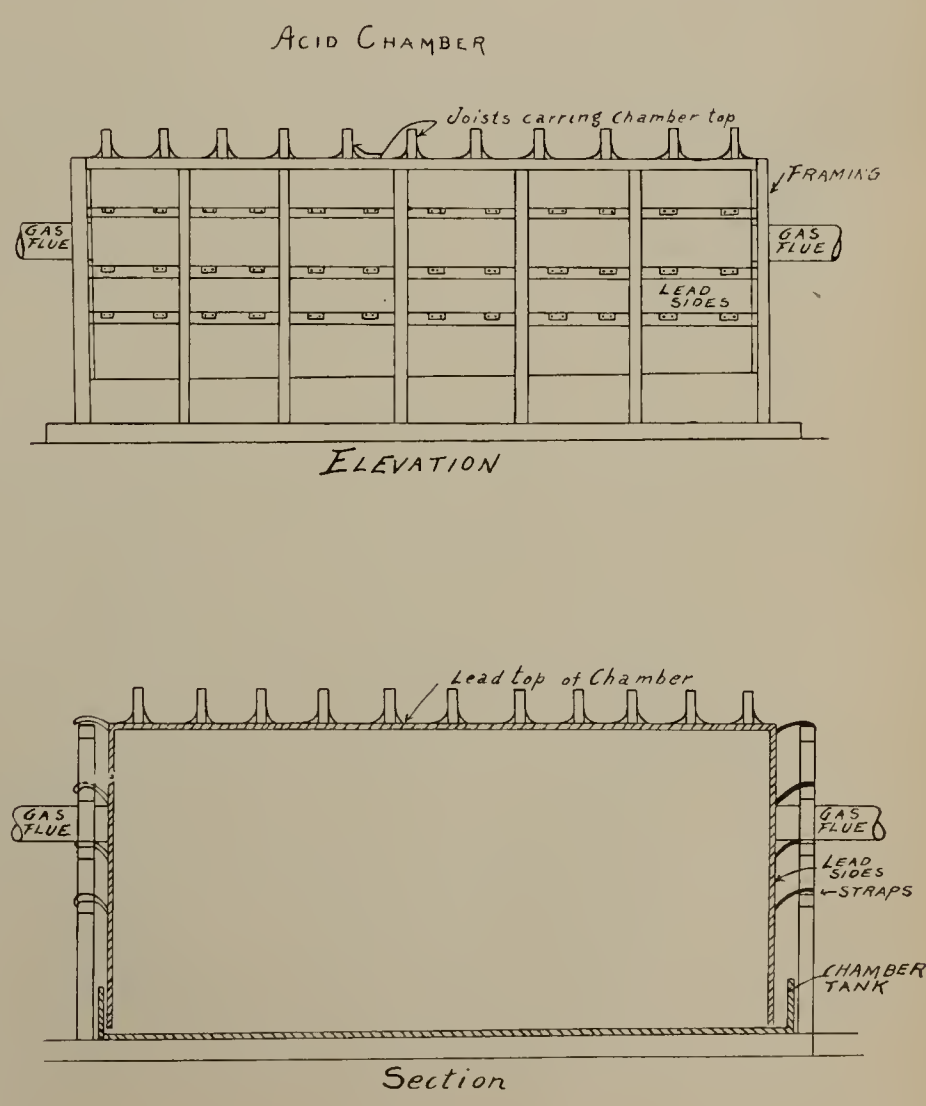
In case of iron pyrites this reduction to metal or self purification does not take place, but somewhere from ½ to 1½ p.c. of sulphur usually remains according to perfection of roasting.

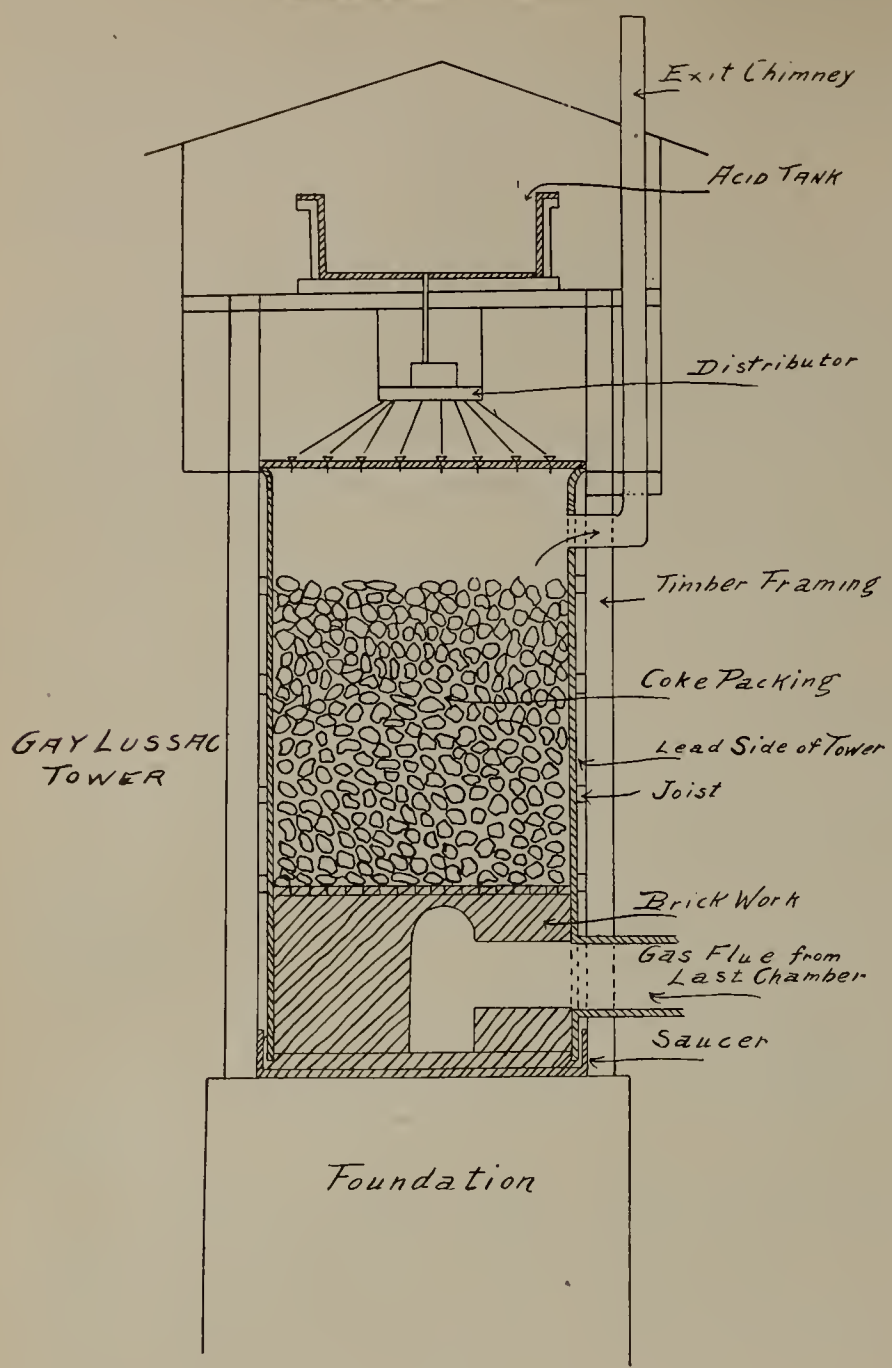
When copper is below 1 p.c. or only in very small quantities, then the purple ore is usually higher in sulphur, as above shown. It is, therefore, not as good for blast furnace material, and yet is used very largely in furnaces that have not the burden with very high sulphur in their other raw material. In many cases where it is not desirable to use it direct as a part of the burden, it is used for damping down the bell of the furnace, so that it is incorporated with the charge in small quantities:

It may be of interest to show the analysis of some of the Newfoundland and Spanish ores and also analysis of some of the purple ores.

ANALYSIS OF PYRITES:

Description.	Iron.	Silica.	Sulphur.	Arsenic.	
1. Pilley Island.....	43.55	5.30	47.17	.29	
2. Fines from Acid Pit....	43.91	1.19	50.07	.27	Moisture .38 Zinc 1.63 Copper .96 Alumina .37 Lime .60 Magnesia .51
3. Pilley Island.....	44.04	3.42	49.03	.09	
4. Pilley Island.....			51.04		
5. Pilley Island.....	40.51	4.68	46.98	Trace	
6. Pilley Island.....			49.03		
7. Spanish Fines.....	43.47		50.03	.16	
8. Spanish.....	44.34		49.33	.08	Copper .36 Barium 1.01 Selenium .15
9. Port Au Port, Nfld	45.57	1.42	51.63	None	
10. do do	44.76	2.04	50.04	None	Copper, none
11. Hunting Island, Gulf St. Lawrence.....	42.39	2.37	48.55	Trace	Copper, none Nickel, trace
12. Pyrrhotite Sudbury....	61.06		36.03	Trace	Copper, trace Nickel 1.09





ANALYSIS OF CINDERS OR PURPLE ORE.

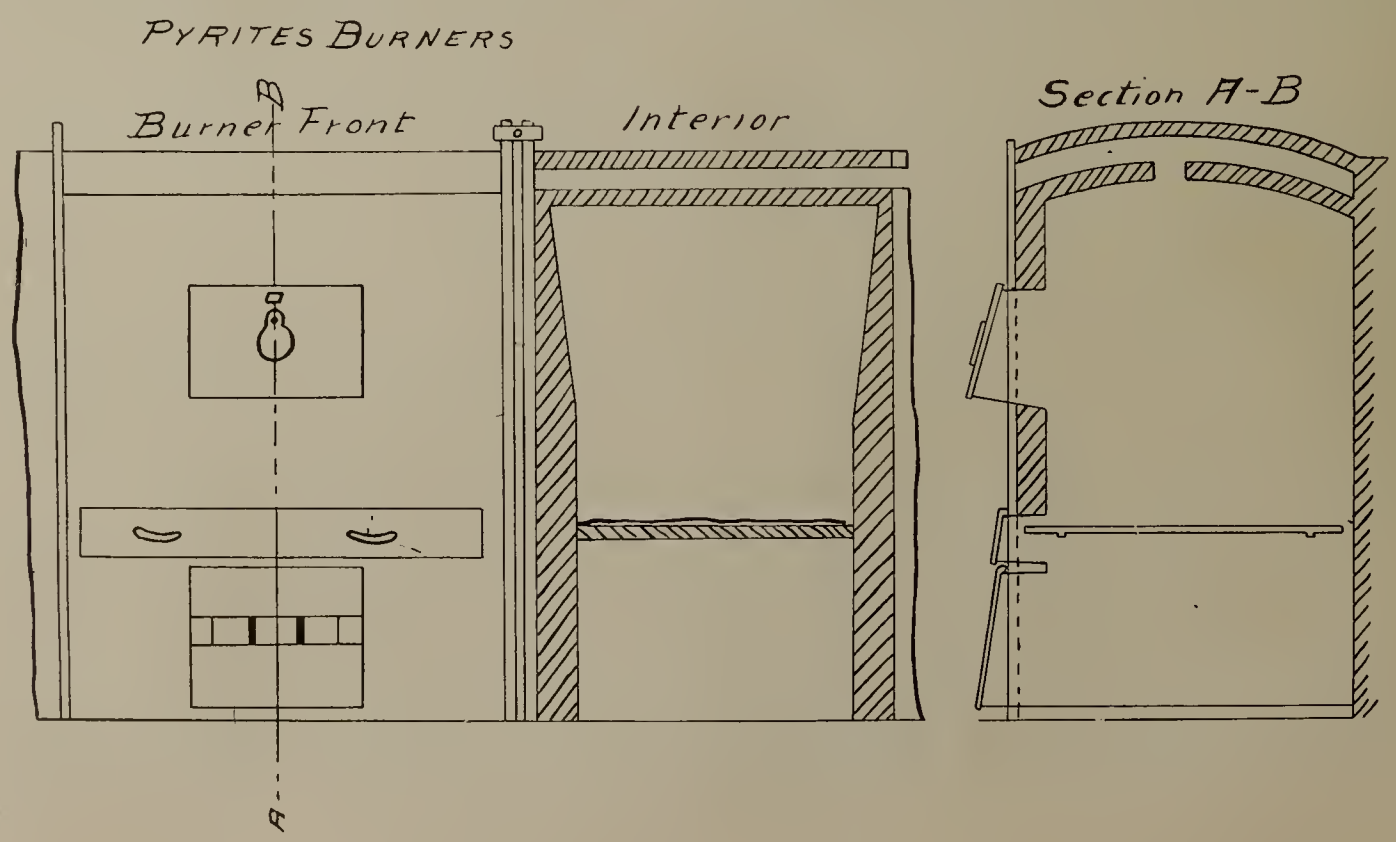
	Spanish.	Norwegian.	Average of German Practice.	Average of Spanish Sydney Practice.	
Fe.	*64.94	*57.00	**65.00	60.00	62.30
Mn.	0.02				Trace
SiO.	2.77	14.30	2.55	2.50	1.85
Al_2O_3.	0.26	3.00			1.00
CaO.	0.41				.10
MgO.	0.07				.43
Cu.	0.12	0.15	0.18		.30
Pb.	1.07	Trace	1.34		
Zn.	0.25	Trace	Trace		.52
CO.	Trace				.24
As.	0.03				
Sb.	0.04				
S.	0.47	0.17	0.36	0.75 to 1.75	1.47
Cl.	0.20	0.01	0.10		
Na.	0.10	from salt admixture			
P.	0.01			0.10	.015
BaO_2.					1.29

*Wedding. **Mostly from Spanish Pyrites.

Another use to which purple ore is put is in the manufacture of pigments. The ore, after it is taken from the furnaces where, in this case, it is not allowed to become any hotter than is absolutely necessary for the burning off of sulphur, is ground to a coarse powder. It is then put into retorts and heated to certain temperatures. According to the degree of temperature, the color of the ore is changed. Hence, any color from a light red to a dark red can be obtained by merely regulating the temperature to which the ore is heated. It is then ground to a very fine powder, thoroughly washed and floated, thus extracting from it any grit which may be present. The fine powder thus washed is separated according to the different degrees of fineness, and is sold sometimes in the pure state, other times mixed with anilines or other coloring matter. This sells from ½c. to sometimes 6c. per pound. It is largely used in the manufacture of paper, especially the so-called "Express" paper where a red color is required. The powder is mixed with the pulp in the beating engine and is retained in the pulp when this goes over the paper machine by the presence of the sizing agents which are mixed in with the pulp. Thus, when the paper comes off the machine, manufactured, it will have any color from a light red to a dark red depending upon the amount and kind of pigment used. It is also used as adulterants in paints, etc.

The Testing of Safety Lamps.

The following interesting letter on the above subject appeared in a recent issue of the *Colliery Guardian*, of London, Eng. The writer is a gentleman well known to most of the mining engineers in this country and has several times contributed articles on the question of safety lamps at the meetings of the Canadian Mining Institute. Mr. Ashworth is recognized as one of the most eminent authorities on this and kindred subjects concerning the safeguards used to prevent the death dealing explosions caused by the ignition of accumulations of noxious gases in coal mines:—



Sir,—In your edition of the 15th inst., I notice an article on "Experimental Galleries for Testing Explosives in Germany and Belgium." In these galleries actual firedamp from the mine has been used after passing twice through a purifier. The writer of this article, having described these galleries, goes on to say that at the Consolidation Colliery, Gelsenkirchen, and at the Frameries, near Mons, there are also galleries for testing safety lamps, and that Herr Beyerling (Gelsenkirchen) performed several tests on gauze cylinders to show their behaviour in an 8 per cent. mixture of firedamp and air. The reported results of these experiments appear to deserve very considerable explanation, as a single cylinder of brass gauze (diameter not named) was burned through when the velocity reached 16 ft. per second (duration of test not given), and a single cylinder of steel gauze withstood the mixture until it attained a velocity of 23 ft. per second, and he adds, even then the gauze did not burst. (Can anyone produce a gauze which has been burst by an explosion of gas within it if properly made?) Also that no explosion was caused when a double cylinder of steel gauze was exposed to a velocity of 36 ft. per second. Coal-dust was used in the explosive tests, why not also in the safety lamp tests? The results of these experiments are so widely different from those obtained by English experimenters that some explanation seems to be highly desirable. M. Stassart's experiments at Frameries pointed out the unreliability of the Mueseler lamp (and other lamps also might have been added) when using interior igniters. It would be interesting to have the dimensions of the earthenware chimney used in the Mueseler, and also to have more details of the experiments made on safety lamps in denser atmospheres than at the surface, which would be tantamount to tests with low and high barometrical readings.—Yours, &c.,

Chaddesden, Derby, James Ashworth.
January 18, 1904.

A New Area of Copper-bearing Rocks in the Eastern Townships of the Province of Quebec.

By John A. Dresser, M.A., Montreal, Que.*

On the latest map of the Eastern Townships, issued by the Geological Survey, three areas of Precambrian rocks are indicated. They form nearly parallel belts, which run in a northeast and southwest direction, generally from twenty to thirty miles apart, and are themselves from two to fifteen miles in width. They usually form conspicuous ridges, which are frequently the highest hills of the district. The intervening areas are occupied by later sediments. The extent and relative position of a part of these belts is shown by the accompanying sketch map (vide American Journal of Science, Vol. XIV, p. 43).

The western and central belts have long been known to be copper-bearing. They have yielded all the copper yet produced in the Eastern Townships, with the exception of that from the Acton and the Huntington mines, and the minor properties in the vicinity of each of these widely different deposits.

In a communication to this Institute in 1902, the writer pointed out that the greater part of these two belts are of volcanic, not sedimentary, origin, as had been previously believed. The view was then also advanced that all of the copper locations of the district of any known, or probable importance, would be found to occur in the igneous portions of these belts, and that those reported from the sedimentary parts of the Precambrian, were likely to be of insignificant value. This view has been fully sustained by the results of two seasons' field work in this region, which have since been carried on for the Geological Survey.

Of the third Precambrian area, that around Lake Megantic, little is yet known. The wooded condition of the country along the boundary of the State of Maine, at the time that the southeastern quarter sheet of the Eastern Townships map was prepared (1885-6), prevented a detailed examination of the area. Yet the rocks were correctly correlated with the others in the Townships already referred to the Precambrian systems (Report of the Geological Survey, 1886, J, Dr. R. W. Ells).

In the summer of 1902 the writer spent a few days in an examination of the rocks in the vicinity of Lake Megantic. Outcrops were examined and specimens taken for forty miles along the western edge of the Precambrian area, and in a southerly course across it from Lake Megantic to the Arnold River, near the Maine boundary. The greater part of the rocks thus seen were found to be of volcanic character, like those of the Sutton and Stoke belts. In a cutting twenty rods in length on the Canadian Pacific Railway, near Boundary Siding, the rock, which is quite similar to the copper-bearing rock of Ascot, is everywhere rusted by the oxidation of pyrites. In the central part of this cutting, copper and iron pyrites, comprise from five to ten per cent. of the rock, through a band upwards of ten yards in width. Copper is reported to occur in the bank of the Arnold River, south of the village of Chaumay, between Lake Megantic and the boundary line of the State of Maine. Owing to high water at the time of my visit I did not go to the locality.

Topographically considered this area seems to be a northern extension of the copper-bearing range of the vicinity of Berlin Falls and Copperville in New Hampshire.

Dr. Chalmers reports the rocks of Ditton in the southern part of the eastern Precambrian area to be similar to those of Stoke Mountain. The latter are volcanics. The two areas, Ditton and Dudswell, (which latter is in the southern part of Stoke Mountain) are further alike in that the gravels of both carry considerable amounts of placer gold. In Dudswell the volcanic rock is evidently the source of the gold, while in Ditton, Dr. Chalmers also considers the gold to have been derived from the rock of the adjacent hills. Hence the occurrence of gold in the rocks farther to the eastward, along the tributaries of the Chaudiere, which has been reported by Logan, Michel, Selwyn and Chalmers, is a probable indication of the continuance of the volcanic rocks in that vicinity.

Further to the eastward, in the highlands of Gaspe, several observers, notably Logan, Ells and Low, have reported the occurrence of rocks characterized by chlorite and epidote, but no detailed microscopic study of them has yet been made. They are presumably a continuation, or recurrence, of this class of copper-bearing traps. Hence it seems probable that the watershed which determines the boundary between the Province of Quebec and the State of Maine, will, as the country becomes accessible for detailed examination, be found to be a continuous ridge, or succession of ridges, of copper-bearing volcanic rocks which may ultimately be connected with the cupriferous Precambrian of New Brunswick.

In view of the prospective opening of this wide extent of country by the projected Grand Trunk Pacific Railway, the actual extent of these rocks is likely to be soon known, and the value of the deposits they may contain becomes a problem of early importance.

*Paper to be read before the March meeting of the Canadian Mining Institute.

Notes on the Construction of Mine Bulkheads.

By William Thompson, Rossland, B.C.*

The writer was recently called upon to design and erect a number of mine bulkheads which required to be absolutely free from danger of collapse and fracture and possibilities of leakage. After consideration of the many classes of material available for this purpose, and various designs of construction, the following general design was decided upon and followed :—

Materials :—

Materials chosen for the erection of the bulkheads were hard burned, repressed brick, manufactured from clay found at Clayton, in the State of Washington, U.S.A., Portland cement imported directly through Vancouver agents from White Brothers, of London, England, and clean river sand found locally. Before being used samples of all materials were tested in the laboratories of Dr. J. T. Donald and McGill University, Montreal, Quebec.

Design of Butkheads :—

In each case the pressure exerted from the head of water to be retained was in one direction. Bulkheads were, therefore, erected in the form of an arch set against footings cut into the solid rock, footings also being cut into the roof and floor of the workings to remove loose or fractured material and make perfect seal against leakage at point of contact between brick work and walls of drift. The first arch was re-inforced by a second arch of similar design and the space between the intrados and extrados of the two arches filled with strong cement concrete. The extrados of the final arch was also sealed by strong cement concrete faced with two-inch cedar plank. The strongest and most perfectly shaped brick were chosen for the construction of the main arches and the mortar used consisted of two parts sand to one cement, freshly mixed as required.

Strength of Materials :—

Brick :—*Transverse test :—*

Distance between centres of support in each case, 6 in.
Specimens tested on flat.
Breaking load at centre in lbs., arch brick 6,500 lbs.
" " " face brick, 3,900 lbs.

Compression Test :—

Load in lbs. per sq. in at initial failure, arch brick, 6,600 lbs.
" " " " face " 2,117 "
Maximum load in lbs. per sq. in., arch " 8,320 "
" " " " face " 3,242 "

Cement :—

Tensile strength in lbs. per square inch :—

Neat cement 20 per cent. water, at end of 60 days, 699 lbs.
One cement and one standard quartz sand, same period, 540 lbs.

One cement and one sand used, same period, 498 lbs.

Plan of Bulkheads :—

Diagram No. 1 shows vertical section, and Diagram No. 2 plan of bulkhead erected to withstand pressure due to 475 feet of water.

A three-inch wrought iron pipe was laid through each bulkhead to carry off water accumulating during construction, this pipe being sealed when water was allowed to accumulate against the face. Bulkheads were maintained free from pressure until material had become thoroughly set.

Results :—

Results obtained proved eminently satisfactory, bulkheads proving watertight, and owing to large factor of safety are free from any danger of collapse or fracture.

*Paper to be presented at the Annual Meetings of the Mining Institute, March 2nd, 3rd and 4th, 1904.

COMPANY NOTES

B. C. Copper Company.—At the British Columbia Copper Company's annual meeting at Charleston, W. Va., important changes were made in the directorate, Messrs. Laidlaw, Thomas and Ropes retiring. F. G. Renner of the stock exchange firm of Woerischoffer & Co., J. C. Reiff, a well known local capitalist, and W. W. Trimpi, president of the Newark River Works, succeeded them. Other directors were re-elected. The consolidation with the Snowshoe is being worked out. Considerably more than the required British Columbia stock has been deposited.

Lightning Creek Gold Gravels Co.—The Annual meeting of the Lightning Creek Gold Gravels and Drainage Company of which Senator James Reid is president will be held in Ashcroft, B.C., on Thursday the 10th of March, when it is expected arrangements will be made for continuing work on this property.

Klondyke Consols, Ltd.—The report issued by Klondyke Consols, Ltd., shows that the mining operations during the past year resulted in a loss, and, to obviate further losses, the csmpany has let out its ground on the lay system. Owing to the low gold values in the ground which has been recently worked, the board are not inclined to run the risk of further losses, they have therefore decided to dispose of their claims to the best advantage, and wind up the company.

Vancouver Oil and Petroleum Synd.—The Vancouver Oil and Petroleum Syndicate has received word from Alberta that a very large pocket of gas has been struck at oil well No. 1 in Alberta. The last news received by the company from the oil fields, reports two wells as being bored. In No. 1 they are in limestone and the indications are that gas has been generated from the oil reservoir beneath this strata. The well is down 1,350 feet.

Cariboo McKinney Mining and Milling Co.—The Greenwood (B.C.) *Times* has the following in a recent issue, respecting the above company : "The Cariboo mine of Camp McKinney is likely to remain closed indefinitely. At the annual meeting recently held in Toronto, a dividend of 4 per cent. was ordered paid, leaving only $5,000 in the treasury, and it was decided to not open the mine. Some time ago the Cariboo was closed and pumps taken out, the local management announcing that there was no further ore in sight. Shareholders in the company were opposed to this action, believing that some of the money in the treasury should be used in development work, and it was confidently believed that further ore bodies could be opened up. It was hoped that this view would prevail at the annual meeting but evidently the majority of shareholders didn't believe in expending any money in development work."

Dominion Coal Co.—The Dominion Coal Co. expects to produce 3,500,000 tons of coal during the present year ; and, their being no demoralization in the Canadian coal trade as in the United States, the company had succeeded in selling for 1904 up to November on the basis of 3,500,000 tons at practically unchanged prices. With respect to the operations of the company Mr. James Ross, president is reported as saying :—"At the annual meeting to be held next month, the company will show very satisfactory earnings for the year, For the year ended February, 1903, the earnings were about $1,717,000 or almost nine per cent. on the common stock outstanding, after payment of fixed chasges and preferred stock dividends. This year, notwithstanding the severe loss at Dominion No. 1, by reason of fire, earnings should be as large as a year ago when all the mines of the company were in operation."

Diamond Vale Iron and Coal Co. (B.C.)—Preliminary arrangements have been completed for the building of a railroad from Spence's Bridge, on the Canadian Pacific Ry., to Nicola Lake, where the Diamond Vale Iron & Coal Co. owns large areas of coal land which it is planning to develop on an extensive scale. This district, which is yet undeveloped, is about equal in mineral resources to the Crow's Nest field.

Payne Consolidated Mining Co.—The Sandon (B.C.) *Standard* is authority for the following item :—The Payne has closed a contract with the Aaron Hirsh & Sohn company, of Halderstadt, Germany, for about 2,500 tons of zinc. The deal was closed last Saturday by S. Hirsh, representing L. Vogelstein, a Wall street broker. The ore will be shipped in bulk and will comprise the most of the year's output of the Payne. With a market for silver, lead, zinc and iron, the Payne should be on velvet before long.

Calumet and B.C. Gold Mine, Ltd.—The fourth cleanup of the stamp mill of the Calumet and B.C Gold Mines took place last week at Camborne and gave values of $8,000, according to the Camborne Miner. The value of the gold in the brick was $7,640 and the concentrates are valued at $360, making the total $8,000. The quantity of rock treated was 900 tons and the total time of the mill run was 690 hours. Although the cleanup was $3,400 less than that of December still it is very satisfactory. The falling off is due to the fluctuating nature of the quartz.

Crow's Nest Pass Coal Co.—The output of Crow's Nest Pass Collieries for the week ending February 12 was 17,956 tons. Coal Creek, 7,233 tons ; Michel, 6,864 tons ; Morrissey, 3,859 tons. Total output for week, 17,956 tons. Average daily output, 2,992 tons. Total output corresponding week last year, 10,472 tons ; average daily output for corresponding week last year, 1,745 tons.

Slocan-Cariboo Mining and Development Co.—At the annual meeting of the Slocan-Cariboo Mining & Development Co. in Toronto, on February 12, it was decided to issue bonds to the amount of $10,000 to enable work to be continued at the company's gold mines on Canadian Creek, near Cariboo, B.C. The money will be partly expended in running a tunnel into the old channel. The report of H. McMaster was to the effect that the claim had been proved to carry gold in paying quantities in two places half a mile apart and that there was good reason to believe that the intervening ground was as rich. It could be economically worked by reason of the limited extent of waste ground having to be worked through to strike the old stream bed. Alfred Ansley was elected president and Charles T. Lyon, secretary-treasurer. George H. Weatherhead and W. J. Chick were added to the directorate.

Le Roi No. 2, Limited.—At the meeting of Le Roi No. 2, further information was given to the shareholders than appeared in the report. Although the chairman was unwilling to state definitely that the concentration process was a proved commercial success in regard to the ores of this company, it seems impossible to doubt that this is the case. It was stated that no ore of a higher value than $5 had been treated, and the ratio of concentration had been entirely satisfactory, in addition to which the cost of oil and oil losses has been very much reduced under skilled management, judging from the statements made by Mr. Elmore. There is every reason, therefore, to anticipate that when ore of the value of seven or eight dollars a ton is concentrated there will be a substantial margin of profit. The action of the auditors in writing off a substantial amount of depreciation was referred to, and although it has the sanction of the board, it is pointed out that with a reduced capital such a course would not have been necessary. The recent discovery at depth in the Le Roi is naturally of considerable importance to this company, as it would appear to prove that they also will find high grade bodies at depth. The board has undoubtedly made a wise choice in their consulting engineer.

NEW COMPANIES.

ONTARIO.

Orion Mining Company, Limited.—Incorporated under the Statutes of Ontario, 18th January, 1904. Authorized capital, $1,500,000 in 1,500,000 shares of one dollar ($1) each. Directors: M. Stewart, L. K. Hyde, I. L. Shank, T. B Westgate, F. Tacky, S. Grumbine, T Canan. Head Office: Niagara Falls, Ont. Formed to acquire the properties known as the "Orion Mining Company, Limited.

The People's Natural Gas Company, Limited.—Incorporated under the Statutes of Ontario, 9th December, 1903. Authorized capital, $100,000 in 4,000 shares of twenty-five dollars ($25) each. Directors: J. Brown, F. J. Ramsay, R. A. Harrison, F. R. Lalor, H. Cockshutt, W. J. Aikens, H. Eagle. Head Office: Dunnville, Ont. Formed to acquire the properties known as "The People's Natural Gas Company, Limited."

Mayo Mining and Development Company, Limited.—Incorporated under the Statutes of Ontario, 8th January, 1904. Authorized capital $250,000 in 5,000 shares of fifty dollars ($50) each. Directors: R. Harcourt, J. L. Harcourt G. Campbell, O. E. Fleming, H. O. Fleming. Head Office: Windsor, Ont. Formed to acquire the properties known as the "Mayo Mining and Development Company, Limited."

The Deep Oil and Gas Company, Limited.—Incorporated under the Statutes of Ontario, 29th January, 1904. Authorized capital, $100,000 in 10,000 shares of ten dollars ($10) each. Directors: L. Teskey, C. E. J. Smith, M. Elliott, L. E. Smith, E. A. Teskey, A. Elliott, A. T. McMahen. Head Office: London, Ont. Formed to acquire the properties known as "The Deep Oil and Gas Company, Limited."

BRITISH COLUMBIA.

Amalgamated McKee Creek Mining Company, Limited.—Incorporated under the Statutes of British Columbia, 19th January, 1904. Authorized capital, $20,000 in 20,000 shares of one dollar ($1) each. Formed to acquire the properties known as the "Amalgamated McKee Creek Mining Company Limited."

Keystone Mines, Limited.—Incorporated under the Statutes of British Columbia, 20th January, 1904, Authorized capital, $50,000 in 5,000 shares of ten dollars ($10) each. Formed to acquire the properties known as the "Keystone Mines, Limited."

British Columbia Mica Company, Limited.—Authorized and licensed under the Statutes of British Columbia, 12th January, 1904, as an Extra-Provincial Company to carry on business. Authorized capital, $1,000,000 in 10,000 shares of one hundred dollars ($100) each. Head Office: Lewisville, N.B. Head Office in this Province: Kamloops, B. C., F. J. Fulton, Kamloops, B.C., Attorney. Formed to acquire the properties known as the "British Columbia Mica Company, Limited."

The International Gold Company.—Registered under the Statutes of British Columbia, 12th January, 1904, as an Extra-Provincial Company. Authorized capital, $15,000 in 1,500,000 shares of one cent (1c.) each. Head Office: Whatcom, State of Washington. Head Office in this Province: Vancouver, B.C. J. Martin, Vancouver, B.C., Attorney. Formed to acquire the properties known as "The International Gold Company."

The Pacific Mineral Extraction Co., Limited,—Incorporated under the Statutes of British Columbia, 29th January, 1904. Authorized capital $100,000 in 100,000 shares of one dollar ($1) each. Formed to acquire the properties known as "The Pacific Mineral Extraction Co, Limited."

Camp Creek Hydraulic Placer Mines, Limited.—Incorporated under the Statutes of British Columbia, 8th February, 1904. Authorized capital $125,000 in 125,000 shares of one dollar ($1) each. Formed to acquire the properties known as the "Camp Creek Hydraulic Placer Mines, Limited."

"The Kamloops Coal Development Company, Limited." "Non-Personal Liability."—Incorporated under the Statutes of British Columbia, 4th February, 1904. Authorized capital, $5,000 in 100 shares of fifty dollars ($50) each. Formed to acquire the properties known as "The Kamloops Coal Development Company, Limited," "Non-Personal Liability."

The Handy Gold Mines Development Co.—Registered under the Statutes of British Columbia, 8th February, 1904, as an Extra-Provincial Company. Authorized capital, $1,500,000 in 1,500,000 shares of one dollar ($1) each. Head Office: Spokane, Washington. Head Office in this Province: Kalso, B.C, A. J. Curle, Kalso, B.C., Attorney. Formed to acquire the properties known as "The Handy Gold Mines Development Company."

CONCENTRATES.

Mr. James C. McNally, U.S. Consul at Liege, Belgium, reports that a representative of the Canadian Pacific Ry. is shipping Belgian coal miners to British Columbia, offering as an inducement wages much in excess of those prevailing in Belgium, and as a result a large number of men have been secured.

A member of the Dominion parliament is drafting regulations for the development of coal property on Indian reserves in the Northwest Territories. It is provided that all persons acquiring mining rights on Dominion lands or upon Indian reserves shall be required to sell direct to consumers, at not more than $1.75 per ton.

The efficiency of compressed air in operating pumps underground in mines is greatly increased by reheating the air at a point near the pumps. This is usually possible where the ventilation is sufficiently good. A compound direct-acting pump, heated sufficiently to prevent freezing, will pump double the amount of water with the use of a given amount of air that a single-acting pump will. Freezing of a mine pump may often be prevented by arranging a drip from a pipe so that a small stream of mine water will fall upon the exhaust opening. This usually keeps the temperature at a point somewhat above freezing. A large exhaust opening is also necessary, and may be kept from clogging with ice much easier than a small one.

An Order in Council has been passed at Ottawa providing that no mining regulations or other regulations for the sale or disposal of Government lands shall apply to the 50,000 acres of coal lands in the Crow's Nest Pass district selected by the Dominion Government. These lands are only to be disposed of as specially authorized by Order in Council.

ROSSLAND ORE SHIPMENTS.—For the week ending Janury 30 shipments aggregated 8,750 tons, as follows: Le Roi, 4,890; Centre Star, 1,320; War Eagle, 1,230; Kootenay, 240; Jumbo, 320; Le Roi, No. 2, 420; same (milled), 30; total for year to date, 40,568 tons.

Prof. Rutherford, of McGill University, to whom a specimen of uranium mineral found in an old mica mine near Murray Bay, Charlevoix county, Que., was submitted for analysis by Mr. J. Obalski, M.E. of Quebec, reports that the mineral contains radium in workable quantity and compares with the best pitch blende used for that purpose in Europe.

PHOENIX, B C., FEB. 13.—The Boundary ore shipments for the week bring the total for 1904 over the 100,000 ton mark. Severe snowstorms nearly all this week have kept the C.P.R. officials busy endeavoring to keep traffic open, and they have been generally successful, although the tonnage is somewhat smaller for the current week. The Athelstan this week, made the largest ore shipments since that property resumed sending out ore last summer, being able to secure all the cars needed. Following are the figures for the week's tonnage from the several Boundary mines;

Granby, to Granby smelter	10,590
Mother Lode to Greenwood	3,040
Emma, to Granby smelter	495
Senator, to Granby smelter	264
Oro Denoro, to Granby smelter	870
Athelstan-Jackpot, to Granby and Greenwood smelters	625
Total for the week	15,884

The total for the year to date is 100,480 tons. This week the Granby smelter treated 13,540 tons of ore, making a total of 77,088 tons this year.

The 1903 output of gold from the Alaskan Territory, U.S. will probably show a larger total than any other previous year. Last year's product has been placed by the United States mint at $8,283,408. The increase in the Nome output last year was not as great as many persons believed it would be. This year the estimate is placed at $6,000,000. The quartz mines of Southeastern Alaska made the best showing during the past twelve months. People are beginning to realize that the quartz fields around the Juneau district are certain to produce an increased amount of gold every year for an indefinite period. The increase in the 1902 product of gold and silver in Alaska amounted to $1,400,254 over the year 1901. The gold product in 1901 was $6,932,226 The increase in gold over the year before was $1,351,181. The 1902 Nome output of gold was $4,542,188, this being an increase of $430,182 as compared with the product of the year before.

COAL CONSUMED BY THE SIBERIAN RAILROAD.—About 300,000 tons of coal are consumed yearly by the Siberian Railroad. The bulk of the coal comes from the mines in the Tomsk and Irkutsk districts of Siberia but the Urals supply most of that consumed on the western section of the line.

The minerals of Korea are of considerable value. Copper, iron and coal are reported as abundant, and gold and silver mines are being successfully operated, an American company having charge of and operating a gold mine at the treaty port of Wunsan under a concession granted in 1895.

SWEDISH IRON ORE EXPORTS.—The exports of magnetic iron ore from northern and Central Sweden in 1903 were 2,537,214 metric tons. Of the total exports, 1,949,477 tons were forwarded to Germany and the remainder to Great Britain, Belgium and other countries.

Osmiridium and platinum have been found in the alluvial gravels of the Horsefly and Bullion districts, in British Columbia. Special appliances are being installed to extract these rare metals.

The Broken Hill Proprietary mine, in New South Wales, is about to manufacture its own sulphuric acid for use in the Delprat process This will obviate heavy first cost and subsequent freight on this chemical. Broken Hill has become a notable stimulant to metallurgical research.

The Gold Run Co.

The following letter which is addressed to the editor of the B.C. *Mining Record* published in London, England will be read with interest, by many people in Canada where the "Count" is so well known. Mr. Carbonneau is a native of Ottawa, but is perhaps better known in Montreal, in which city he found more scope for his remarkable financial abilities.

Sir,—Some twelve months ago you took occasion to comment on the formation of a Klondike mining company, formed to operate an extensive territory on Gold Run Creek. In your role of critic and adviser on Canadian mining matters, you characterised these claims worthless, and made many libellous and untrue statements against myself. A vindictive newspaper article seems to lose much of its importance at a distance, more especially when the person attacked is in his own country and among those who actually know the true facts of the case. You may remember, if you follow the remarks of the local press, that every paper took strong exception to your remarks, as being absolutely unjustifiable. As I have lived and worked in Klondike for five years, this fact speaks for itself.

Your attack on me was as bitter as it was unjustified, and had I at that time been in London, I should have taken immediate action.

The company I had formed, being the most important, both in size and proved value of the properties, which has yet been brought out, required my entire time and energies, and to speak frankly, your critism has in no way affected my own or the company's welfare.

My object in writing to you is to enclose a copy of the first balance sheet of the company, which has just been passed by the auditors, a London firm of the highest standing.

You will see that from March to October last year, gold to the value of £100,526 was washed from the company's claims, and we have been able to distribute dividends amounting to £79,566, a proof of the richness of the claims and the economy of the management which has, I think you will admit, never been equalled by any other Klondike company.

As your remarks as to to the value of this company's properties have proved so entirely at variance with facts, you may, possibly now do justice both to the company and its originator.

Yours truly,

C. E. CARBONNEAU.

15, Avenue D' Autin,
Paris.
3rd February.

Pig Iron Production in Canada.

The American Iron & Steel Association has received direct from the manufacturers the statistics of the production of all kinds of pig iron in Canada in the Calendar year 1903. They show a decrease of 54,139 gross tons, or nearly 17 per cent, as compared with 1902, but an increase of 20,442 tons as compared with 1901.

The total production in 1903 amounted to 265,418 gross tons, against 319,557 tons in 1902. In the first half of 1903 the production was 132,930 tons and in the second half it was 132,488 tons, a falling off of only 442 tons. Of the total production in 1903, 247,905 tons were made with coke and 17,513 tons with charcoal. Nearly one-half of the total production was basic pig iron, namely, 126,892 tons. Less than 1,000 tons of bessemer iron were made. Spiegeleisen and ferro-manganese have not been made since 1899.

The following table gives the total production of all kinds of pig iron (including spiegleisen and ferro-manganese) in Canada from 1894 to 1903 Prior to 1894 the statistics of pig iron production in Canada were not collected by the Association.

Year.	Tons.	Year.	Tons.
1894	44,791	1899	94,077
1895	37,829	1900	86,090
1896	60,030	1901	244,976
1897	53 796	1902	319,557
1898	68,755	1903	265,418

The unsold stocks of pig iron in Canada on December 31, amounted to 19,168 tons.

On December 31, 1903, Canada had 15 completed blast-furnaces, of which 9 were in blast and 6 were idle. Of this total, 11 were equipped to use coke for fuel and 4 to use charcoal. In addition, 3 coke furnaces and 1 charcoal furnace, were being built or were partly erected on December 31, but work on at least two of the furnaces had been suspended some time ago.

The Dominion Iron & Steel Company, of Sydney, N. S., had all four of its furnaces running during 1903, although two only were in operation on December 31. No date has been set for the blowing in of the idle furnaces.

The Londonderry Iron & Mine Company, of Londonderry, N. S., did not operate either of its furnaces in 1903. During the year it rebuilt furnace A and expected to have it in blast about the middle of January. This stack is now 75 by 17 ft., and has an annual capacity of about 45,000 gross tons of foundry pig iron. The Company is uncertain whether it will rebuild furnace B, which has been long idle.

The Nova Scotia Steel & Coal Company operated Ferrona furnace, at Ferrona, N. S., for 48 weeks in 1903 and was running it on December 31. The new furnace which the company is erecting at Sydney mines, in Cape Breton county, will probably be completed in June, 1904. It will have a daily capacity of 200 tons.

The Canada Iron Furnace Company was re-lining its furnace at Radnor Forges, Quebec, on December 31, but expected to have it ready for blast about the middle of January. The furnace ran for 41 weeks last year. The Midland furnace of the company, at Midland, Ont., ran for 45 weeks last year and was active on December 31.

John McDougall & Co. had one of their two furnaces at Drummondville, Que., in blast on December 31. The idle furnace may resume work during the coming summer.

The Algoma Steel Company, Limited, of Sault Ste. Marie, Ont., had two furnaces completed and ready for blast on December 31. The date when they may be blown in is uncertain.

The Deseronto Iron Company of Deseronto, Ont., operated its charcoal furnace for 46 weeks in 1903, and was running it on December 31.

The Hamilton Steel & Iron Company, Limited, of Hamilton, Ont., was operating its furnace on December 31. It ran for 43½ weeks last year.

General De Wet as a Promoter.

SYNDICATE NOW BEING FLOATED BY LATE BOER LEADERS.

War time wounds are being healed rapidly. Convincing evidence of this is forthcoming in the presence of Christian R. de Wet, Judge Hertzog, and Mr. J. G. Celliers, upon the directorate of an enterprise imposingly designated "The National Options Syndicate, Limited." With three ex-Boer Commandant-Generals, this Syndicate is somewhat out of the ordinary, and for this reason the prospectus deserves consideration. Of the capital of £100,000, the vendors, who are presumably included in the directorate, are to receive 45,000 shares and £5,000. Working capital is to be £25,000, and 25,000 shares constitute the reserve Besides the gentlemen designated, the other Directors are Messrs. H. Jasper Smith, W. H. Poultney, and James Hosking.

A few features of the prospectus rather indicate that Boers make better terms with Boers than do Britishers negotiating options. The assets consist of the right to prospect and the option to acquire *at one pound per morgen, in cash or shares, all metals, minerals, precious stones, coal, mineral oils, etc., and all mining rights, absolutely.* The vendors are to continue to negotiate options. For what they have already obtained they are to be paid £20 per farm, actual expenses.

The present area over which options have been acquired is about 500,000 acres, and it is expected that the options in the hands of the Syndicate will soon be increased to over one million acres. Of the 500,000 acres already secured, the rights of the Syndicate over about 40,000 acres, consist of *perpetual* options to purchase the mineral rights absolutely at £1 per morgen in cash or shares *without further payment* for option money. The rights over the remaining 460,000 acres consist of a five years option *without further payment*, to purchase absolutely the whole of the mineral rights at £1 per morgen in cash or shares. The option on any farm can be continued *indefinitely* after the expiration of five years by payments of £50 per annum.

The claim is made that the Syndicate has been, and will be, enabled to secure many valuable options (which would otherwise have been unobtainable) owing to the *unique terms* of their options and the influential agents acting for them. "The terms of the options are such that, while the Syndicate obtains all mineral rights, the farmers retain the surface rights (beyond what is necessary for mining purposes) in all circumstances, and the Syndicate has the benefit of the services of many of the leading officials in the late Transvaal and Orange Free State Republics. The value of these two considerations is evident to all having experience of the Boer people. The farms are said to have been selected because of indications thereon of diamonds, mineral oils, gold, copper, lead, zinc, coal, iron, etc" Several

of the farms are in the Boshof District, and are reported to carry diamondiferous formations similar to that of the Kimberly District. "One of these farms, on the Vaal River, is bounded on the east and on the west by farms on which diamonds are being found. Several ofhers in the Orange River Colony have oil shales, natural gas, and coal, besides both precious and base metals. Gold, copper, lead, coal and iron, as well as asbestos, nitrates, etc., are found on the Transvaal farms."

The farms are arranged in amalgamated areas of from 40,000 to 50,000 acres, and, for the purposes of prospecting or purchasing, each such area will be treated as a unit, and any options exercised by the Syndicate to purchase will extend to the whole of each amalgamated area. In conclusion this optimistic document states: "Prospecting must be commenced before the end of November next. Most of the farms are highly mineralized, and in all probability will require little money spent prospecting them before the developments will amply justify the formation of subsidiary companies. It is believed the profit accruing therefrom will provide sufficient funds for carrying on the business of the Syndicate without resorting to further issue of share."—*South African Mines*, Johannesburg, S.A.

Coal in War Time.

As the fat is now in the fire and the navies of Japan and Russia, are at it "hammer and tongs," the following excellent editorial from one of the leading authorities on the British coal trade, will no doubt prove of timely interest to the readers of the REVIEW:

"In a recent leading article we discussed at some length the position of coal in time of war; but in view of the importance of the subject, especially at the present time, some further consideration of it may not be unprofitable, for when there is any possibility of naval war between two Powers whose respective Governments are on good terms with England, British coal merchants cannot help feeling anxious with regard to the safety of cargoes which are on their way to foreign ports. The doctrines of international law are not always capable of precise interpretation, nor, when clearly appreciated, are they rigidly observed by all Great Powers. Every modern war witnesses the advent of new weapons and machinery for which existing rules of international law on questions of contraband, etc., do not provide. Further, though all nations readily attach their signature to conventions and treaties in "piping times of peace," some of them are only too ready to disregard their obligations during hostilities when they realize that by doing so they may gain an important advantage. To the coalowner and merchant, however, the question of greatest interest is whether coal is to be treated as contraband of war. Unlike the muniments of war themselves, coal is an article which is not only of the first importance in naval warfare, but which serves the needs of peaceful citizens in belligerent states. It would, therefore, be unjust in the highest degree if the law of nations were to place an absolute embargo upon the delivery of coal at belligerent ports for any purpose during the progress of hostilities. It may be of interest to consider the present state of international law with regard to the transport of coal and then to make some reference to the effect of a war upon policies of insurance which may have been taken out for the protection of coals sent, or about to be sent, from this country to one or other of the belligerent Powers.

The rule to be deduced from treaties and international conventions upon the question whether coal is contraband of war appears to be, as we recently pointed out, that coal is *conditionally* contrabrand—that is to say, the question must be answered in relation to each particular cargo. To take an illustration. The coal on board a ship which was under charter to deliver it to one of the belligerent fleets at sea could be declared contraband and confiscated by the other belligerent. This is a statement of international law which would probably be accepted by every civilized country. The question whether coal on board a ship which is bound for the port of a belligerent is open to more difficulty, and is not answered in the same way by the Great Powers. For instance, in 1870 Germany protested against the delivery of any English coal at French ports during the war, but British Ministers, although they restrained the delivery of coal to French warships at sea, permitted merchantmen flying the British flag to deliver coal at French ports. In view of this German protest, it would seem that Germany's attitude is to make coal contraband of war in all cases. The position of Russia is very diffierent. At the West African Conference, as we have before noted, she gave a complete denial to the right of any country to declare coal to be contraband, and pronounced her determination never to sign any treaty or convention which contained any stipulation of the kind. How far she will consistently abide by this decision when she is next involved in a naval war remains to be seen. For instance, in the case of a war with Japan, would a Russian cruiser not interfere if an English collier were delivering coal to a Japanese warship? English merchants will surely act on the safe side if they assume that coal consigned, directly or indirectly, to belligerent States is liable to capture.

It is most important to consider the effect of war on policies of insurance. Such policies usually contain what is known as the "neutral clause," which provides in effect that if the law of nations with regard to neutrality shall not be observed, the underwriters are absolved from the consequences. By the law of nations, as interpreted in this country, the following rule has been firmly established as a principle of our laws of war:—If, during war, neutral property be engaged in any branch of the Colonial or coasting trade of the enemy, which is not open to foreigners in time of peace, such property loses its character of neutrality, and becomes liable to hostile capture. This rule

stands on two grounds :—(1) That the neutral, by thus acting, interposes to relieve the enemy from the condition to which the other belligerent has reduced him, and to that extent deprives that belligerent of the advantage he had gained. (2) That the neutral employed in a trade, reserved by the enemy to his own subjects, identifies himself with that enemy and assumes his character. In the words of Lord Mansfield :—"If a neutral ship trades to a French colony with all the privileges of a French ship, and is thus adopted and naturalized, it must be looked on as a French ship, and is liable to be taken." Carrying simulated papers is a ground of capture and condemnation, and, if without leave expressly given in the policy, it is a breach of the warranty of neutrality ; and, in the United States, carrying suspicious papers has been held to be a breach of warranty. It has also been held in the United States, and apparently, on sound principles, that an attempt to disguise belligerent goods as neutral, and carrying them as such with neutral cargo, is a breach of the warranty of neutrality, and will void a policy of insurance as to the neutral cargo, though if the same goods had been taken on board as enemy's goods, aud so documented, the only effect would have been to expose them to confiscation. We shall discuss this subject with sufficient clearness if we deal with the "warranty of neutrality" which appears in a policy of marine insurance. The meaning of a warranty of neutrality is not only that the ship or goods are neutral owned at the time the policy is effected, but that, so far as depends on the conduct of the assured or his agents, they shall be neutral for the purpose of being protected on the voyage ; and therefore that the ship shall be navigated according to the law of nations, and also be furnished with all the documents and papers which are the evidence of neutrality, and her observance of the regulations of those international treaties to which she is bound to conform. If the coal which is the subject of the insurance be *in transitu*, or in the course of consignment from a vendor to a vendee, it is not enough, in order to satisfy a warrant of neutralily, that the property be neutral-owned at the commencement of the transit, for if it be consigned by neutral owners to a hostile destination in pursuance of a contract made during war, it is liable to hostile capture while in transit. The English rule is that neutral property going to be delivered in the belligerent country, and under a contract to become the property of the belligerent immediately on arrival, is to be considered as belligerent property unless the contract was made in time of peace, and without any contemplation of war. It is to be observed that if a neutral coal vessel were to carry despatches for either belligerent she might become liable, with the whole cargo, to confiscation. In view of the foregoing circumstances, exporters will be well advised to carefully consider the terms of every charter party and policy of insurance when sending coal to the Far East, should war come about between Russia and Japan."—*Iron and Coal Trades Journal*, London, Eng.

Largest Breaker in the World.

Says the Wilkes-Barre *Record*:—Ground was broken last June for the foundation of what will be the highest, largest and most modern coal breaker on earth, that of the new Nottingham of the Lehigh & Wilkes-Barre Coal Co., at Plymouth. The foundation, which was finished about 10 weeks later, is of solid concrete and is a massive piece of work. The first stick of timber was erected on September 19 of last year and the frame work is now about finished. All that remains to be done is to erect the headhouse, which is under way. hhere will be 1,750,000 feet of timber in the breaker.

The contractors are Lamoureux & Smith, and these men have pushed the work vigorously, and were it not for the rigors of the present winter they would have had the siding in place and most of the machinery, also. The building will be 172 feet in height and will have a capacity of 3,000 tons daily.

There will be four tracks underneath and four sets of chutes, from which all sizes of coal, from steamboat to birdseye, will be loaded.

It is the intention of the Lehigh & Wilkes-Barre Coal Co. to run all the coal from the Reynolds mine through this breaker and with that object in view a track from the Reynolds along the D.,L. & W.R.R. tracks up to the Nottingham will be laid and thence hoisted into the breaker.

A large steam pump, capable of pumping 2,300 gallons of water in a minute, will be used to wet the coal and prevent the dirt and dust from flying into the air and damaging adjacent property. The breaker will have hundreds of windows, each containing 32 lights. I will be illuminated with electricity and for that purpose a large dynamo has been ordered. Later the current will be conveyed to the Lance colliery at the upper end of Plymouth, and that also will be illuminated in like manner.

The machinery, which will be of the latest and most improved type, will be operated as at present by steam. Millions of nails and spikes were used in the construction of the breaker, and enough iron has been used in it to keep a large foundry going for some time. The siding of the breaker will be of sheet iron, similar to that of the No. 3 D. & H. breaker. A happy incident in connection with the erection this building is that not a man or boy was injured, notwithstanding the fact that dozen were employed during the time that the timbers were covered with sleet and snow for weeks. It will be some time before it will be ready to run coal through, but when that day arrives the event will be celebrated in a fitting manner by the company.

Artificial Diamonds.

In the November issue of the *Moniteur Scientifique* M. Combes discusses the various attempts which have been made to obtain the diamond artificially. Against the common supposition that the diamond can only be produced at high temperatures, the author cites several observations which seem to indicate that natural diamonds, at any rate, cannot have been formed under such conditions. The hypothesis that high pressures are necessary for the artificial production of diamond is not in accord with actual experimental facts, and the author arrives at the conclusion that in the experiments of Moissan the pressure plays no essential part, and that the optical properties and the analysis of the crystals obtained by this chemist do not warrant the conclusion that these are to be regarded as diamonds.

IN THE HIGH COURT OF JUSTICE.

MERCHANTS BANK OF CANADA vs. STEWART et al.

JUDICIAL SALE

OF

Canadian Anthracite Coal Company Stock

PURSUANT to a Judgment and Order for Sale of this Court, made in this action, tenders will be received by William Louis Scott, Esquire, Local Master of this Court at Ottawa, at his office in the Court House in the City of Ottawa up till 12 o'clock noon on WEDNESDAY the 16th day of MARCH next (1904) for **755** fully paid up **shares** of the par value of $100.00 each in the Capital Stock of **The Canadian Anthracite Coal Company, Limited,** (a body corporate, incorporated by Letters Patent of the Dominion of Canada). The Company's mines are situated near Calgary in the Northwest Territories of Canada.

Tenders may be made for the whole 755 shares or for any smaller number thereof.

Tenders must be sealed and addressed "W. L. Scott, Esq., Local Master, Court House, Ottawa, Canada," and marked "Merchants Bank vs. Stewart, Tender for shares", and each tender must be accompanied by a certified cheque payable to The Merchants Bank of Canada, for not less than ten per cent of the amount of such tender. Such cheque will be returned in the event of the tender not being accepted.

Upon the acceptance of any tender the balance of the purchase money shall be paid into Court to the credit of this action within thirty days thereafter and the purchaser shall thereupon be entitled to a transfer of the shares covered by his tender. In the event of the purchaser failing to pay the said balance of the purchase money the deposit of ten per cent above mentioned shall be forfeited and the shares may be re-sold and any deficiency thereon shall be made good by the defaulter.

The purchaser will prepare the transfer of shares at his own expense and will tender the same for execution and all expenses incidental to the investigation of title and the registration of the transfer shall be borne by the purchaser.

The highest or any tender will not necessarily be accepted.

Further particulars may be had from Messrs. Wyld & Osler, Messrs. Gemmill & May, Messrs. Lewis & Smellie, Messrs. Murphy & Fisher, Messrs. MacCracken, Henderson & McDougal, Messrs. Gorman & O'Connor, Messrs. Christie, Greene & Hill Messrs. Hogg & Magee, Messrs. Nellis, Monk & Matheson, Messrs. McLaurin & Millar, and Messrs. Gormully & Orde, Barristers, Ottawa; and Mr. Adam Johnston, Barrister, Morrisburg, Ont.

Dated at Ottawa the 6th day of January, A.D. 1904.

(Sgd.) W. L. SCOTT,
Master at Ottawa.

Gormully & Orde,
33 Sparks Street, Ottawa,
Vendors' Solicitors.

CANADIAN MINING INSTITUTE

ANNUAL MEETINGS

The Annual General Meetings of the members of the Canadian Mining Institute for the transaction of business, the discussion of papers, etc., will be held in the

KING EDWARD HOTEL, TORONTO

ON

WEDNESDAY, THURSDAY and FRIDAY
. . . . . 2nd, 3rd and 4th MARCH, 1904 . . . . .

SINGLE FARE ON RAILWAYS.

BY special arrangement members will be carried to Toronto and returned for a SINGLE FARE on the Canadian Pacific, Grand Trunk, Intercolonial, Quebec Central, and Canada Atlantic Railways. In order to secure this rate members and mining men who purpose being present at the meetings must obtain from their Ticket Agent the ordinary form of Convention Certificate provided by railways. They wlll purchase a one-way trip ticket to Toronto and on presentation of Certificate duly vized by the undersigned will be returned free of charge.

INSTITUTE GOLD MEDAL.

The Council of the Institute will award a Gold Medal for the best paper contribnted by members to the Transactions of the Institute during the year 1904.

STUDENTS' PRIZES.

In addition to the President's Gold Medal the Council offers three prizes of a cash value of twenty-five dollars each for the best papers contributed by Canadian mining students on the following subjects :—

GROUP I.—ORE DEPOSITS AND MINING GEOLOGY.—The subject may be treated generally, or some particular district or single deposit may be discussed or described.

GROUP II.—MINING PRACTICE—Any and every branch of mining may be treated such as pumping, hoisting, ventilation, timbering, ore extraction, development, etc., etc., or some particnlar method of mining, or some individual mine or group of mines, may be described or discussed.

GROUP III.—ORE DRESSING AND METALLURGY—Any branch of ore dressing or metallurgy may be treated as for example—crushing, jigging, milling, concentrating, smelting, roasting, cyaniding, etc., or some particular plant may be described or discussed.

Competitors must advise the titles of their subjects to the Secretary of the Institute not later than the 18th February next and MSS. must be sent to him on or before the opening session of the meeting on 2nd March.

SYLLABUS OF PAPERS.

Syllabus, embracing over forty papers, and detailed programme of arrangements for these meetings will be mailed to members in due course.

EUGENE COSTE,
PRESIDENT.

B. T. A. BELL,
SECRETARY.

ANNUAL CONVENTION

OF

Canadian Mining Engineers and Mine Managers

TO BE HELD UNDER THE AUSPICES OF

THE CANADIAN MINING INSTITUTE

will be held in the King Edward Hotel,
City of Toronto, on

WEDNESDAY, THURSDAY and FRIDAY, 2nd, 3rd and 4th MARCH, 1904.

Special Excursion on 6th March to Niagara Falls, visiting Power Plants and Electro-Metallurgical Works.

SINGLE FARE TO ALL MINING MEN ON CANADIAN RAILWAYS.

Among the contributors of papers are the following:—

Dr. Eugene Haanel, Dominion Superintendent of Mines; Prof. Miller, Mr. James McEvoy, Mr. Eugene Coste, E.M., Mr. A. J. Beaudette, Mr. J. N. S. Williams, Mr. C. A. Meisner, Mr. W. M. Brewer, Dr. Ami, Mr. Wm. Thompson, Mr. F. T. Snyder, Mr. D. G. Kerr, Mr. W. E. H. Carter, Mr. E. D. Ingall, Mr. L. J. Robe, Mr. E. B. Kirby, Mr. F. Keffer, and others.

OFFICIAL PROGRAMME LATER.

EUGENE COSTE, President.

B. T. A. BELL, Secretary.

DOMINION OF CANADA

SYNOPSIS OF REGULATIONS

For Disposal of Minerals on Dominion Lands in Manitoba, the North-West Territories, and the Yukon Territory.

COAL.

Coal lands may be purchased at $10.00 per acre for soft coal, and $20.00 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at such rate as may from time to time be specified by Order-in-Council shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding Free Miner's certificates may obtain entry for a mining location.

A Free Miner's Certificate is granted for one or more years, not exceeding five, upon payment in advance of $10.00 per annum for an individual, and from $50.00 to $100.00 per annum for a company, according to capital.

A Free Miner having discovered mineral in place may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end of the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a Mining Recorder's Office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.00.

At least $100.00 must be expended on the claim each year or paid to the Mining Recorder in lieu thereof. When $500.00 has been expended or paid the locator may, upon having a survey made and upon complying with other requirements, purchase the land at $1.00 per acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of royalty on the sales not exceeding five per cent.

PLACER MINING, MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

Placer mining claims generally are 100 feet square; entry fee, $5.00, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

DREDGING IN THE RIVERS OF MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

A Free Miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental $10.00 per annum for each mile of river leased. Royalty at the rate of two and a half per cent., collected on the output after it exceeds $10,000.00.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the rivers below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100.00 per mile for first year, and $10.00 per mile for each subsequent year. Royalty ten per cent on the output in excess of $15,000.00.

PLACER MINING IN THE YUKON TERRITORY.

Creek, Gulch, River, and Hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other Placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end bearing notices. Entry must be obtained within ten days if the claim is within ten miles of Mining Recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a Free Miner's certificate.

The discoverer of a new mine is entitled to a claim 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee $15.00. Royalty at the rate of 2½ per cent. on the value of the gold shipped from the Territory to be paid to the Comptroller.

No Free Miner shall receive a grant of more than one mining claim on each separate river, creek, or gulch, but the same miner may hold any number of claims by purchase, and Free Miners may work their claims in partnership, by filing notice and paying fee of $2.00. A claim may be abandoned and another obtained on the same creek, gulch, or river, by giving notice, and paying a fee.

Work must be done on a claim each year to the value of at least $200.00, or in lieu of work payment may be made to the Mining Recorder each year for the first three years of $200.00, and after that $400.00 for each year.

A certificate that work has been done or fee paid must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a Free Miner.

The boundaries of a claim may be defined absolutely by having a survey made, and publishing notices in the *Yukon Official Gazette*.

HYDRAULIC MINING, YUKON TERRITORY.

Locations suitable for hydraulic mining, having a frontage of from one to five miles, and a depth of one mile or more, may be leased for twenty years, provided the ground has been prospected by the applicant or his agent; is found to be unsuitable for placer mining; and does not include within its boundaries any mining claims already granted. A rental of $150.00 for each mile of frontage, at the rate of 2½ per cent. on the value of the gold shipped from the Territory. Operations must be commenced within one year from the date of the lease, and not less than $5,000.00 must be expended annually. The lease excludes all base metals, quartz, and coal, and provides for the withdrawal of unoperated land for agricultural or building purposes.

PETROLEUM.

All unappropriated Dominion Lands shall, after the first of July, 1901, be open to prospecting for petroleum. Should the prospector discover oil in paying quantities he may acquire 640 acres of available land, including and surrounding his discovery, at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by Order in Council

JAMES A. SMART,

Deputy of the Minister of the Interior.

OTTAWA, 9th Dec., 1901.

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction oi 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee oi $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P. Q.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents anuually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

CONTRACTORS TO H. M. GOVERNMENT

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Rutherglen, Glasgow, Scotland

MANUFACTURERS OF

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Wire specially selected for own exclusive use.
We have made many records with our Winding, Haulage and Crane Ropes.

Illustration of ¾" diar. Special Improved Patent Steel Wire Rope, 1760 yards long, supplied to Dalzell Colliery, Motherwell, Scot., which ran two years and 8 months, shewing condition when taken off. Previous rope from another maker lasted 1 year and 9 months

TELEGRAMS—"Ropery Rutherglen. A B C, A I and Lieber's Codes used.

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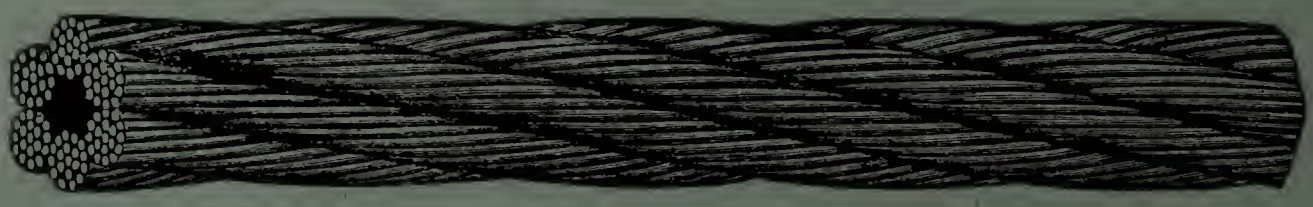

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12 lbs. 18 lbs. 25 lbs., 30 lbs., per Yard

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TWENTY-SECOND YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

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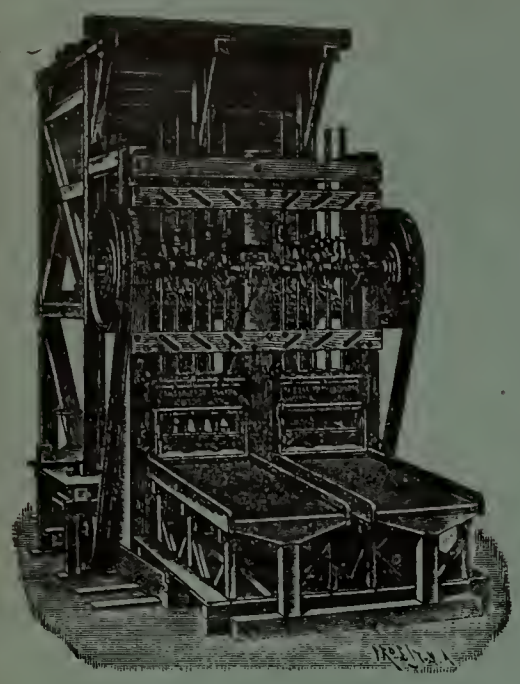
Magdeburg-Buckau (Germany)



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for dry and wet crushing, more than 1,800 at work.

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Shoes and Dies of Krupp's Special Steel.

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Complete Gold Ore Dressing Plant

a. For treating by the Wet Method with Stamp Batteries, Amalgamation and Concentration.
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Large Testing Station for Crushing and Dressing Ores at the Works.

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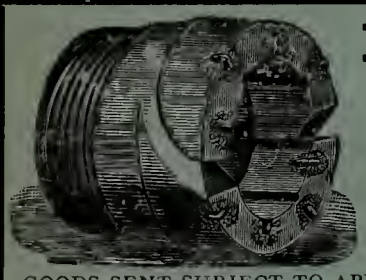
For Mexico: PABLO BERGNER, Apartado 549, MEXICO.
For South Africa: UNITED ENGINEERING CO., Ltd., P.O. Box 1082, JOHANNESBURG, S.A.R.



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A California logger says, "Your POWER ROPE is far ahead of any we have ever used, is now in use 10 months and will last several more. Has handled more logs per month over a worse road than any of our previous ropes. Have never obtained over two or three months' service from other makes."

A Washington logger writes, "I desire to say that your POWER WIRE ROPE is the best I have ever used. Have given it the roughest kind of usage, not only for yarding purposes, but for building roads as well and notwithstanding the rough usage, there is not a single broken wire in the rope."

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"HOBSON," ASCHROFT, B.C.

J. B. TYRRELL
Late of the Geological Survey of Canada.

MINING ENGINEER

DAWSON . . . YUKON.

Telegraphic Address—Tyrrell, Dawson.
Code used—Bedford McNeil's.

MILTON L. HERSEY, M.Sc. (McGill)
CONSULTING CHEMIST OF THE C. P. R.
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CIVIL AND MINING ENGINEER
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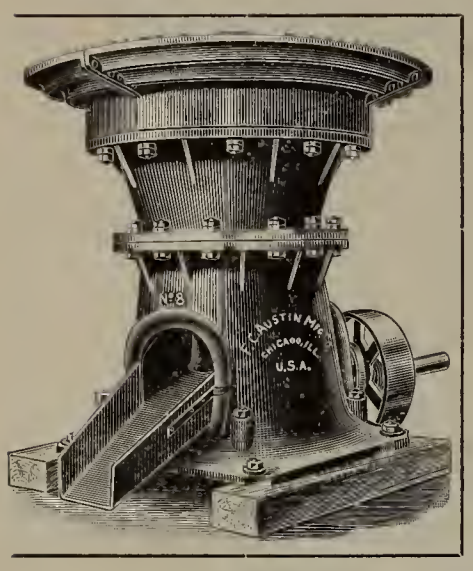

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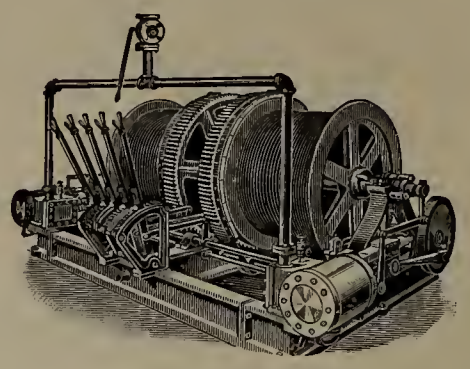

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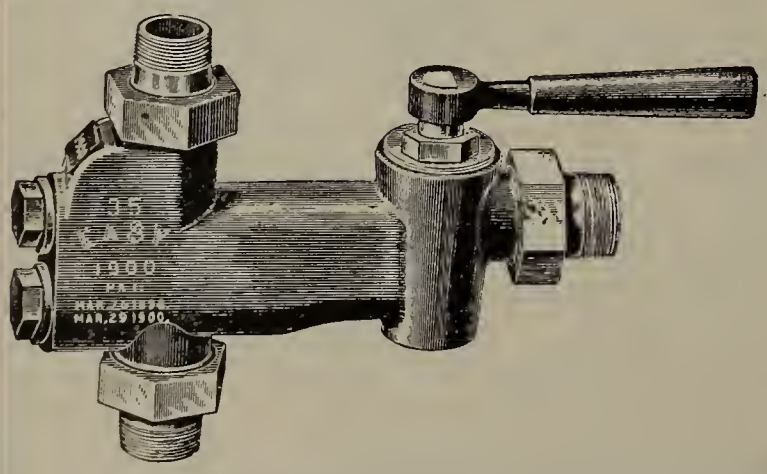

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22nd YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

THE OLDEST AND ONLY OFFICIAL MINING AND ENGINEERING JOURNAL PUBLISHED IN THE DOMINION OF CANADA.

Estate of B. T. A. Bell, Proprietor. PUBLISHED MONTHLY. Office: Orme's Building, Ottawa.

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CONTENTS.

Announcement.

Announcement is herewith made to the readers, subscribers and advertisers of the CANADIAN MINING REVIEW that the publication of the REVIEW will be continued for the present by the Estate of the late Mr. B. T. A. Bell.

It will be the object of the present management to continue the high character and disinterestedness of the paper, and to carry forward the work which the late proprietor had so much at heart.

Biographical Notice of B. T. A. Bell.

The relations of Benjamin Taylor Bell to the CANADIAN MINING REVIEW, and to the Mining Institute, justify the publication of an extended notice of his life, and of the loss which the mining industry has sustained in his death.

He was born at 41 India Place, in the Parish of St. George, Edinburgh, on the 2nd day of July, 1861. His father was Dr. David Bell, and his mother, Margaret Taylor. Owing to the curious fact that there was another Benjamin T. Bell at school with him, the letter A was introduced into his name solely as a distinguishing mark at school, and to his friends and intimates he was better known as "B. T. A." than by any other name.

His early education was received in the private schools of Edinburgh, and was completed at Stewart's college in that city. As a boy he developed that independence of thought and quickness of action which characterised him as a man and which was early shown in his educational career by his decision that *seeing life* was better than *schooling*. The sequel to this decision was a hasty journey, unknown to his parents, to the city of London whence his return to the city of his birth was summarily accomplished by his father, who, in good old Scotch fashion, spared not the rod. The recital of this incident by Mr. Bell to his intimates was always told with a keen relish of the humor of the situation.

As a result of this incident, the young man served a limited time with the engineering firm of D. & J. Greig. After the death of his mother, and at the age of 21, he decided to leave the old country and see something of life in the Colonies. In the Spring of 1882 he landed at Halifax, N.S., and travelled immediately west to Brandon, Manitoba, in company with four other "cannie scots," who began western life in a tent on the prairie outside of the town. In this tent they lived until October when the "shack" they had builded was finished. Finding through hard experience, that farming, even on a partnership basis, required some capital he turned his hand to any jobs that came along and found himself quite famous as a canvas sign painter.

In 1883 he secured a clerkship in the Freight Department of the Canadian Pacific Railway, at Winnipeg, and was thereby brought into quite close relationship with Mr. John M. Egan, then General Superintendent of the Western Division of that railway. He remained with the railway until the summer of 1884. When at Rat Portage with Mr. Egan in that year the Manitoba Coutingent of the Canadian Voyageurs, bound for the Nile, passed through the town en route for Egypt. Seeing some of his old chums amongst the contingent, and full of youth, patriotism and daring, he at once handed in his resignation to Mr. Egan, was enrolled by the officer commanding, (Colonel Kennedy) and in less than six hours from the entrance of the contingent into Rat Portage, he was en voyage as one of that gallant band of voyageurs who did honor to themselves and to their country in the Soudan war for the relief of the christian martyr, General Gordon. For service in this campaign Mr. Bell received the Egyptian Medal and Star.

On the termination of the Soudan expedition he returned to London with the contingent, was there discharged from service and at

once left with a friend (Mr. Lawrence J. Clark, now of Calgary) to do a walking tour through the Caledonian Canal district.

In 1885 he returned to Canada, landing at Montreal where he was attached to the Prince of Wales Rifles, serving as lieutenant, and expecting to see fighting in the so-called Riel Rebellion. The Rifles, however, were never ordered into active service, and he took up newspaper work, assuming the editorship of the Athletic News, a sporting paper of that day. He also did occasional work on the staff of the Montreal Gazette and Montreal Witness, and, on the occasion of his visiting Ottawa in 1886 with a cricket team, he was asked by one of the proprietors of the MINING REVIEW, Mr. W. A. Allan, to assume the editorship of that paper.

The MINING REVIEW at that time consisted of 6 or 7 pp. of reading matter, chiefly obtained by the aid of scissors and paste pot, and was ostensibly devoted to the furtherance of the phosphate mining industries. It was then owned by Mr. W. A. Allan and Mr. Grant Powell, and the absence of the latter gentleman in England was the occasion for the need of an editor.

To the privileged few who have seen the complete files of the MINING REVIEW from its first number, the energy and devotion of Mr. Bell are obvious. He put his unrivalled vitality into the work, and the results have been apparent. In 1887, his name first appeared on the paper, and shortly afterwards he became joint proprietor with Mr. Allan; in January 1896 he became the sole proprietor of the paper.

The fearless criticism of the REVIEW, its outspoken condemnation of fraudulent promotions, and its hostility to underhand methods, have been the characteristics familiar to all readers under Mr. Bell's editorial rule. For the first ten years of his control the REVIEW averaged one action for libel in each year, no one of which was sustained, and the private letters on the file of the paper, as well as the published comments of other journalists, at home and abroad, show the esteem in which the REVIEW has been held. Whatever its failings the REVIEW has been marked for years with the label "our columns cannot be bought."

As an organizer and a magnetic force B. T. A. Bell best showed his ability in the various associations and institutes of mining men with which he was connected. When the taxation measure known as the "Mercier Mining Act" was passed in November, 1890, the mine owners of Quebec Province were aroused to joint action, and the General Mining Association of Quebec was formed in the following January. Of this association Mr. Bell was the Secretary and backbone.

Prior to this organization there had been formed in Nova Scotia the "Gold Miners Association" in the month of March, 1888. After a year's successful experience this association, on the 6th of March, 1889, adopted a resolution making the CANADIAN MINING REVIEW its official organ, and Mr. Bell was afterwards a frequent visitor at its meetings. Realising the value of concerted action in legislative matters, as shown in the three years successful work of this small provincial organization, he was successful in the establishment of the General Mining Association of the Province of Quebec.

The following year the coal owners in Nova Scotia, being adversely affected by proposed and enacted legislation, united with the gold men into the Mining Society of Nova Scotia; at the second meeting Mr. Bell was present, and by his speeches and personal magnetism effected a co-operation though no amalgamation, with the General Mining Association of the Province of Quebec.

In 1894 he formed a Mining Institute in Ontario, and in January 1896 he realized the dream of five years in getting all the provincial organizations to combine into one formation which was known as "The Federated Canadian Mining Institute."

After three annual sessions of this Federation the present Canadian Mining Institute was born, which has thriven and grown nnder the advice and protection of its late Secretary to the magnitude of an important and influential technical body whose suggestions are heeded in every Parliament in the Dominion, and whose published volumes are sought for by Governments, Societies and individuals, from Manila and Australia to California and South Africa.

For fourteen years he devoted his best energies and his talented abilities to the construction and maintenance of an institution within which should be included every technical man, and every monied man whose interests were in mining and metallurgical matters, throughout the Dominion of Canada; the volumes of the Canadian Mining Institute are a portion of the monument to his memory which he himself built, and the love and esteem of his Institute fellow-members is a yet more enduring, and beautiful memorial to his kindly disposition, to his helpful hand, and to his masterly knowledge of human nature.

He was always an enthusiastic sportsman and athlete, his favorite game being cricket, in which he obtained considerable eminence. When playing with the Canadian team in 1886 he made the highest aggregate score known in Canada, totalling that season 1306 runs for 36 completed innings. He also was a member of the Canadian Eleven chosen to visit England in 1886, and also played on the Canadian International Eleven.

In January 1889, he married Sydney, the eldest daughter of Henry F. MacCarthy, Esq., of Ottawa, to whom was born, in June 1890, one son, Gerald Gordon Bell.

In no spirit of exaggeration, and with strict deference to the truth may it be said that no man in Canada can fill his place. Persistent, enthusiastic, dominant, he exercised an influence which was positively unique in this Dominion. And, as the years roll by, the loss which the whole country has sustained in the death of Benjamin Taylor A. Bell will be revealed to all citizens as it now is revealed to those who knew him and loved him well.

The War Eagle Report.

The Seventh Annual Report of the War Eagle Mining and Development Company, Ltd., was submitted at the Shareholders' meeting held on the 23rd of last month.

There are no substantial changes in the accounts which are favorable to the financial position of the corporation, the balance of loss being $278,274.92 for 1903, against $308,615.39 for 1902.

It is gratifying to note that the net proceeds from ore sales were increased some $110,000 over the sales for 1902.

The tonnage mined was the largest in the history of the mine, not even excepting the period ending December 31st, 1899, when the change in the mining year made the figure then tabulated the product for 15 months instead of 12 months. The average monthly tonnage for 1903 was in excess of 5,000 tons, while in 1889 the monthly tonnage was a little less than 5,000.

The assay value for 1903 was $13 per ton; in 1902 (the lowest of previous years) it was $18.79—a shrinkage of $5.79 per ton. This value is the lowest yet recorded for the mine.

The balance of the report is largely on the lines of the Centre Star Report to which full reference was made in the columns of the REVIEW for December last. The success of any concentration method means as much for the shareholders of the War Eagle Company as for anyone, and it will be of untold value in the rehabilitation of British Columbia investments into the good graces of mining investors.

The Crow's Nest Pass Coal Company.

The annual meeting of the Crow's Nest Pass Coal Company was held in Toronto on the 12th of February when the Seventh Annual Report of the Directors was submitted. The Report shows in the Profit and Loss Account the very large item of $913,526.25 as a "Premium received on calls paid on new stock"; the previous amount from this source received was, we believe, $812,209, making a total revenue from the premiums on the sales of new stock (to date) of $1,725,735. This amount is strong evidence of the favor in which the stock is regarded by the public, and the record of the Company must constitute the justification for this high premium, either in the cash profits which have been earned, or in the unquestioned prospects of immediate profits in the future. It would appear from the statements of the President and Vice-President, made at the Annual Meeting, that the demand for both coal and coke is steadily increasing; this is evidenced by the construction of 492 additional coke ovens which were commenced in the year 1903, 252 being at Michel and 240 at Morrissey, bringing the total number of ovens, when the new ones are completed, up to the number of 982.

The output for the year must be considered satisfactory, especially in view of the curtailment in production owing to strikes and the explosion. The tonnage mined in 1903 was 661,118 as against 442,049 for the year 1902. The increase in coke production has also been notable, the output of the ovens in 1903 being 167,989 tons against 121,000 tons in 1902, or an increase of 38 per cent.; the increase in the output of coal was nearly 50 per cent. It is now admitted by the consumers in British Columbia that the supply of coal and coke is in excess of the demand, and, should consumers exercise ordinary business prudence and lay in large stocks of both coal and coke, the closing down of the furnaces of the Province through lack of fuel brought about by strikes and explosions, will not be probable in the future.

The report of the Directors does not give the amount of sales made to the different markets, but the President admitted that there is yet a much larger market for coke in the State of Montana, which is asking for supplies. It is well known that a great deal of steam coal is furnished to the Great Northern Railway, and the different towns which it serves, and that large supplies of coke go to the Great Falls smelters.

Comment on the price of the shares and the probable return that will be earned and distributed upon such price is not at present of general interest to our readers, but it certainly seems as though the usual dividend rate, which holders of coal mine shares are accustomed to receive, will not be exceeded by this Company, and that the price of the shares may fall, and this for many reasons, not the least of which is the supplying of the local provincial demand by the Canadian Pacific Railway from the mines which that large corporation owns.

The Toronto Meeting of the Mining Institute.

The Toronto meeting of the Canadian Mining Institute must be pronounced to have been a very successful affair, notwithstanding the shock and gloom occasioned by the sad death of its deeply lamented Secretary, and in spite of the curtailment of the programme occasioned by the abandonment of the banquet on Friday evening, and of the excursion to the power plants at Niagara. The number and character of the papers presented does not fall below those of any other meeting and the attendance was both large and representative.

Discussion is the life of all such gatherings, and there was plenty of it at this meeting. The paper of President Coste, which dealt with the character of the existing Dominion Regulations and Provincial Mining Acts, was an able statement of many reasons why such Statutes work an injury to the mining industry, not only by their evasions, loopholes, and lack of regularity, but also by their omissions. It is to be regretted that this paper was put down for the concluding session of the meeting, as it provoked more discussion than any other paper read. As it was, discussion had to be restricted during the closing hours, but the REVIEW hopes that written discussion will be continued.

Other notable features of the meeting were the increased time given to Stbdents' Papers, some of which were very able, and the fact that this was the first time the annual meeting had been held elsewhere than in Montreal. The success of the Toronto meeting leads to the hope that the Council will repeat the innovation whenever circumstances warrant it.

CORRESPONDENCE.

The Mountain Lion Mine, U. S. A.

TO THE EDITOR.

SIR:—

As many of the larger shareholders of this Company live in Montreal, Toronto and Ottawa, an account of the operations of the Mountain Lion Gold Mine may be of interest.

This mine is owned by the Mountain Lion Gold Mining Company, Limited, with Mr. A. E. Palmer, formerly of Buckingham, Que., as President, and comprises 6 patented claims in the Republic Mining Camp, State of Washington, in close proximity to the Boundary.

There are three quartz veins on this property, the most important one and the one which carries the highest values. having a width on the surface of 26 feet. This vein has been developed by a system of shafts, drifts and tunnels. The present crosscut tunnel taps this vein at a depth of 275 feet from the surface and has a total length of 1,300 feet, the vein being cut at 800 feet from the mouth of the tunnel in a width of 18 feet. From this point a shaft was sunk to a depth of 350 feet, giving a total depth of 625 feet. Below this point it is reported sinking is in progress, and before long this mine will have an explored depth of approximately 1,000 feet. The width of the vein as determined by a great amount of development work, varies between 8 feet and 20 feet, while the average values keep between 11 and 13 dollars per ton. There are, however, shoots of ore, which assay 35 dollars and occasionally 72 dollars per ton; such a rich ore shoot was crosscut by the main tunnel and formed a part of the main ore lode. It is remarkable, that in the Republic Camp the ore values towards the depth are higher than on the surface. This feature has been observed in the Mountain Lion, in the Republic Mine and in several other properties. The main vein of the Mountain Lion carried no value on the surface; at a depth of 20 feet the values increased to 4 dollars per ton, and at 50 feet the average value across 12½ feet of ore was $11.50 per ton; at a depth of 275 feet a rich ore shoot was encountered, showing values of over 70 dollars per ton over the full width. The mine since the beginning of actual operations has had to undergo a great many difficulties, especially as regards the rational and successful treatment of its ore. When the Republic Mine had its mill in operation from 1898-1899, it was found, that the Amalgamating-Cyaniding process as worked out by Pelatin-Clerici was not a success on account of the heavy losses in gold. The percentage of saving was only from 55-75, and the cost of treatment 8 dollars per

ton. Experiments were then carried on, both with Republic and Mountain Lion ore, on a large scale and several cyaniding experts came to the conclusion that the Republic ore could be treated successfully by the combined stamp-mill-amalgamating process with subsequent pulverizing and cyaniding. The Gold and Silver Extraction Company of America then undertook the responsibility for the treatment of the Mountain Lion ore at a royalty of 10 cents per ton, at the same time time guaranteeing an extraction of at least 85 p.c of the gold and 60 p.c. of the silver values. A mill for the employment of this process was constructed in 1899 at a cost of about $45,000 and was started for actual treatment of the ore on the 16th of March, 1900, but the results obtained were far from being satisfactory. From May to October of the same year altogether 11,960 tons were treated, the average saving being only 54.9 p.c. of all the values at a cost of $3.73 per ton. In consequence of these disappointing results the mill was closed on November 1, 1900. Further metallurgical tests were made with the ore and though the results showed some encouragement as to the probable improvement in the extraction, should further modifications of the plant and process be made, still, after the experience already gone through and the failure of previous metallurgical experts to verify their predictions, it was not deemed advisable to incur any expenditure for further mill modification, especially in view of the fact that at that time it was within the bounds of certainty that a railroad would soon be constructed to the town of Republic. This would give an opportunity of selling the ore to the smelters located on the line, which were desirous of obtaining a certain quantity of silicious ore hitherto procurable only in a limited measure. When this railroad, (the Kettle Falls R. R.), was completed, arrangements were at once made to make contracts for the delivery of ore with the smelters, and to resume operations at the mine. Since the beginning of August, 1903, ore has been shipped from the Mountain Lion Mine at the rate of 120-150 tons per day, to the different smelters in the Boundary country, the Hall Mines and the Granby Smelter, but it was questionable whether, even with freight and treatment charges as low as $6.50 per ton, a reasonable profit could be made. Again, it was found, that the market for the Republic ore was not so large as anticipated, as the self fluxing character of the Boundary ores does not allow of any large additions of pure silica. In October last year tests with the ore were resumed, this time with an entirely new process, invented by Dr. Hendryx, of Los Angeles, Cal., and from the results already obtained, it appears that this process has a fair chance of success. It is claimed that it recovers more than 90 p.c. of the gold and from 60 to 80 p.c. of the silver, with an average recovery of 86 p.c. of the total values; it is also claimed that the cost of treatment would not exceed $1.50 per ton. Since the beginning of December, 1903, the old mill of the Mountain Lion Mine has been altered to the Hendryx process, and a fifty ton agitator added; the total cost of all these alterations has been in the neighbourhood of $5,000. The stamps of the old mill began crushing ore on the 3rd of February for a thorough trial by this process, and it is reported that the first clean up was very satisfactory. Since then several changes in the mill were made and several lots of ore treated, but up to the beginning of March no data as to the treatment were received. If the Hendryx process, employed on a large scale, will give the results which have been claimed for it, it is evident that a new and prosperous era will follow after years of stagnation and disappointment; the Mountain Lion Mine has very large ore reserves; it was never a question of value or quantity of ore—it was the treatment of the ore which, up to this time, has laid so many obstacles in the way.

FRITZ CIRKEL.

Montreal, 10th March, 1904

To the Editor.

SIR:—

I trust you can find space for enclosed appreciation of Mr. Bell.

THE LATE B. T. A. BELL.

(AN APPRECIATION.)

Ten years last November, I found myself for the first time in Canada, among strangers and in what looked a wild bleak place, for already three feet of snow covered the ground and to a green Englishman everything was strange and desolate. I soon discovered however, that there was something unique in the social qualities of Black Lake, Quebec (for that was the place), typified by the Asbestus Club, where for a fortnight I was entertained right royally and made to forget that I was far from home and its allurements. That friendly and hospitable coterie, long since scattered, can never be forgotten—L. A. Klein, Capt. Penhale, A. M. Evans, John Penhale, Cather, Murphy, and last, but not least, George Smith. To these came, three days before I left, B. T. A. Bell, with whom I struck up a firm friendship that strengthened as the years wore on and finally deepened into profound respect. Few men have seen as much of B. T. A., and none experienced more of the genuine kindness which was part of his big, generous heart. His personality attracted and charmed me from the first and in ten years I have known no one who could resist him. In his capacity of Secretary of the various Mining Societies and Institutes which he founded and fathered, he did many things which aroused antagonism. This was due largely to his wider experience, his deeper insight, and his forceful nature. He became restive if opposed and could ill brook the slow movement of less alert and incisive minds. In the end he always won out. I do not recall a single instance in which his judgment did not ultimately prove right.

His magnetism was so great that at times it carried opposition away as by a breath, indeed I have rarely met a man whose personality counted for so much. In Council, with Bell absent, there might be criticism and even the formation of a cabal to upset some of his schemes, with Bell present they fell like cardboard houses before his impassioned and convincing attack.

What the Canadian mining interests lose can never be told. His services in fostering mining societies and, finally, building up a Canadian Institute, were colossal, and completely successful, and his departure leaves one of the best and most firmly established Institutes in the mining world, especially noted for its admirable re-unions every year, when our late friend was the life and soul of the whole movement. Of his services to mining literature, it is impossible to speak too highly. His annual reports on mineral production were most valuable and highly appreciated. In the pages of the MINING REVIEW he attacked every wild scheme and dishonest promotion that came under his notice—its pages were open to exposure of everything that would tend to weaken the industry he loved so well and did so much to serve. It mattered not how big the corporation, or how wealthy the syndicate, if there was a cloven hoof he would expose it. So generous was he that more than once he incurred serious responsibility rather than "back down" or betray his correspondents; and so keen was his judgment in such matters that, through nearly twenty years of caustic criticism, he never had to withdraw a statement. Absolutely fearless and just, he was the terror of mining frauds, and in this sphere Canada will lose much by his demise.

At forty he had attained a position where his worth was recognized and his recent appointment on the Yukon Commission was only an earnest of higher service for the country of his adoption. We shall go on a little little longer, and with another to lead us, but it will not be a Bell. In his absence we shall muse on the undaunted spirit that so often cheered and stimulated us—that never failed a friend and never quailed before a foe. None more truly exemplified the spirit of Henley's virile stanza:

"It matters not how straight the Gate
How fraught with punishments the Scroll,
I am the Master of my fate,
I am the Captain of my Soul."

Nelson, B. C., March 18th, 1904. WM. BLAKEMORE.

BENJAMIN TAYLOR A. BELL

Born 2nd July, 1861. Died 1st March, 1904.

SIXTH ANNUAL MEETING

OF THE

CANADIAN MINING INSTITUTE

HELD AT

Toronto, Ont., March 2nd, 3rd and 4th, 1904.

The annual meeting of the Canadian Mining Institute was called for the 2nd, 3rd and 4th days of March, and a Council meeting for the evening of the 1st of March. The Council meeting lacked a quorum, and in view of the sad death of the Secretary, additional members were invited to be present in order to transact the necessary business, such business afterwards to be reported to a quorum of the Council for approval.

The President announced that news of the death of the Secretary, which occured that morning at ten minutes past ten, had been communicated to the Institute in a telegram from Mr. Hardman, and that the President and Treasurer on receipt of the news had telegraphed and written letters of condolence to Mrs. Bell.

Messrs. Coste, Brown and Leckie were appointed as a delegation to represent the Institute at the funeral in Ottawa on Thursday afternoon.

By resolutions it was voted, to abandon both the Banquet on Friday night and the excursion to Niagara Falls on Saturday ; also to adjourn the Thursday afternoon meeting during the funeral of the late Secretary.

Other formal business was transacted and the Council adjourned.

The first session of the Sixth Annual General Meeting of the Canadian Mining Institute opened in the Banquet Hall of the King Edward Hotel, Toronto, on Wednesday morning the 2nd of March at 10 o'clock.

The following signed the register of attendance :—

Eugene Coste, Toronto.
W. G. Miller, Toronto.
S. Dillon-Mills, Toronto.
Elfric Drew Ingall, Ottawa.
R. W. Brock, Kingston.
Jno. McLeish, Ottawa.
J. Stevenson Brown, Treasurer, Montreal.
Frederick Hobart, New York.
J. Obalski, Inspector of Mines, Quebec.
Alfred E. Barlow, Ottawa.
James White, Ottawa.
B. A. C. Craig, Toronto.
J. M. Clark, K.C., Toronto.
J. A. Currie, Toronto.
Major W. Parsons, Toronto.
John Piche, Copper Cliff, Ont.
C. H. Heys, Toronto.
Jas. H. Bowman, London, Ont.
C. Garratt, Sudbury, Ont.
Dr. Robert Bell, Ottawa.
Robert G. Leckie, Sudbury.
J. A. Dresser, Montreal.
J. E. Hardman, Montreal.
E. J. Davis, Toronto.
Dr. J. Bonsall Porter, Montreal.
Jos. Errington, Massey, Ont.
R. C. Barclay, Massey, Ont.
G. E. Silvester, Sudbury, Ont.
J. L. R. Parsons, Toronto.
E. B. Biggar, Canadian Engineer, Toronto.
Thos. W. Gibson, Toronto.
A. P. Coleman, Toronto.
Wm. Thompson, Rossland, B.C.
Anthony Blum, Boston, Mass.
E. L. Fraleck, Belleville, Ont.
M. J. Hendrick, Belleville, Ont.
O. N. Scott, Listowel, Ont.
P. Kirkegaard, Deloro, Ont.
S. F. Kirkpatrick, Kingston, Ont.
A. F. Rising, Madoc, Ont.
H. H. Moore, Toronto.
T. L. Walker, Toronto.
J. J. Bell, Toronto.
A. Ferland, Haileybury.
M. B. Baker, Kingston.
Wm. Nicol, Kingston.
Frank D. Adams, Montreal.
F. T. Snyder, Chicago.
C. C. Richards, Montreal.
T. D. Ledyard, Toronto.
H. G. Deyell, Montreal.
A. Longwell, Foxboro, Ont.
J. C. Gwillim, Kingston.
John Hart, Hampstead.
B. O. Lott, Stirling.
John W. Cook, Marmora.

STUDENTS.

R. Anson Cartwright, Kingston.
Benj. Tett, Kingston.
P. McL. Forin.
R. O. Steachan, Kingston.
E. T. Corkill, Kingston.
C. G. Williams, London, Ont.
F. N. Rutherford, South Monaghan.
C. L. Coulson, Welland.
E. R. Jackson, Seaforth.
Robt. H. Bryce, Toronto.
A. J. Elder, Barrie.
P. A. Laing, Dundas.
W. M. Edwards, Iroquois.
P. C. Coates, Toronto.
J. F. Hamilton, Toronto.
T. H. Plunkett, Toronto.
J. Parke, Toronto.
H. C. Chilver, Walkerville.

C. A. Chilver, Walkerville.
Chas. J. Ingles, Toronto.
M. T. Culbert, Toronto.
Henry Montgomery, Toronto.
J. Galbraith, Toronto.
J. G. MacMillan, Toronto.
J. H. Ryckman, Frontland.
W. A. Begg, Toronto.
C. W. Knight, Kingston.
L. E. Drummond, Kingston.
J. S. DeLury, Manilla, Ont.
R. E. Hore, Toronto.
G. C. Bateman, Kingston.
T. W. Cavers, Kingston.
K. A. MacKenzie, Toronto.
Geo. W. Bissett, Kincardine.
L. B. Reynolds, Montreal.
E. J. Hassard, Toronto.
Ralph E. DeLury, Toronto.
Jas. G. Ross, Barrie.
A. T. Stuart, Hamilton.
H. A. G. Baker, Oshawa.

The meeting was called to order at half-past ten o'clock by the President, Mr. Eugene Coste, E.M. The minutes of the last annual meeting were read and approved.

The report of the Council for the past year having been printed and distributed, the President said :—

I may say gentlemen that the preparation of this report was the last work done by our late secretary. I received the report from him the morning he met with the fatal accident which caused his death, of which you were informed yesterday.

On the motion of Mr. J. Stevenson Brown, seconded by Professor Miller, the report was adopted.

TREASURER'S REPORT.

Mr. J. Stevenson Brown, Treasurer, presented the financial statement for the year, which was as follows:

TREASURER'S STATEMENT.

Year Ending February 1st, 1904.

Receipts.

Balance from last year		$1,682 49
Subscriptions, 284 at $10.00	$2,840 00	
Student members, 9 at $2.00	18 00	
University members, 76 at $1.00	76 00	
Arrears collected	210 00	
		3,144 00
Sale of Journals		40 25
Dominion Government Grant		3,000 00
Interest		13 05
		$7,879 79

Less.

Disbursements per statement	4,831 06
Balance on hand	$3,048 73

Audited and found correct,

GEO. MCDOUGALL,
H. W. DECOURTENAY,

SUMMARY STATEMENT.

Showing distribution of Disbursements to the various Work and Business of the Institute.

Publications :			
Cuts, Line drawings, Half tones, etc.	$	387 99	
Copying, Proof reading and Charges re Vol. VI		1,300 00	
Printing, etc		153 19	
Postage, Express, and other charges		122 26	1,963 44
Library :			
Rent		271 66	
Care of Library		40 00	
New Books		76 00	
Binding		32 00	
Furniture and Signs		187 25	
Removing to Ottawa		62 37	
Insurance		17 00	686 28
Meetings :			
Reporting Annual Meeting		100 00	
Typewriting, Copying, Annual Dinner and Sundry disbursements		278 90	
Council Meetings		135 00	
Deputations		255 10	
Advertising		50 00	819 00
Secretary's Office :			
Annual Grant		500 00	
Postage and Telegrams		61 12	
Stationery and Typewriting Supplies		77 38	638 50
Treasurer's Office :			
Annual Grant		500 00	
Bank charges on Cheques and Drafts		62 35	
Postage and Telegrams		40 00	
Stationery and Sundries		36 49	
Audit		10 00	648 84
Prizes :			
L. P. Silver		25 00	
H. P. DePencier		25 00	
N. W. Parlee		25 00	75 00
			$4,831 06

J. STEVENSON BROWN,
Treasurer.

MONTREAL, February 1st, 1904.

Mr. J. STEVENSON BROWN—I may point out that this statement shows that about $130 were received more than is stated in the report of the Council. That is due to the fact that between the 1st, of February and the present date a number of members have paid their subscriptions. I would also like to point out that the balance appearing there, amounting to over $3,000, is larger than it should be when all the accounts are paid. Owing to the unfortunate fire which took place at Ottawa, the Sixth Volume of the Journal of the Mining Institute, which was about ready to be issued, was destroyed. It will entail extra expense to have the volume re-issued. There are about eight hundred dollars involved in that, and the payment of that amount will only be made this year, so that the balance should be about two thousand two hundred dollars. I should like also to explain that in former years

the Secretary was given a fixed sum which was intended purely for the running of the office, and it was customary for him to employ extra help as he required it in connection with the pressing work of the Institute, and particularly the issuing of the volume of our Transactions. However, last year instead of giving the Secretary an allowance as formerly, we gave him a fixed sum of fifteen hundred dollars to cover all the expense of the office, and the extra help required. Of this amount, five hundred dollars is charged to the Secretary's office and a thousand dollars was put down to the cost of publication.

On the motion of Mr. Obalski seconded by Mr. Mills, the report of the Treasurer was adopted.

NEW MEMBERS.

The following new members were elected :—

A. Harry Hook, Chemist, 9 Suffolk Place, Toronto, Ont.

H. B. Wright, Chief Engineer Crow's Nest Pass Coal Co., Fernie, B.C.

Henry L. Manley, Mining Engineer, Crow's Nest Pass Coal Co., Fernie, B.C.

Milton T. Culbert, Geologist, 226 McCaul St., Toronto, Ont.

Herbert C. Philpott, 320 Brunswick Avenue, Toronto, Ont.

S. L. Spafford, Capelton, Que.

Robert McKay, Barrister, Messrs. McKay, Dods & Grant, Toronto, Ont.

H. S. Burrell, Belleville, Ont.

J. L. R. Parsons, Geologist, 12 Lowther Avenue, Toronto, Ont.

Anthony Blum, Mine Owner and Mine Operator, 35 Court Street, Boston, Mass.

Elfric Drew Ingall, Mining Engineer, Geological Survey, Ottawa, Ont.

A. P. Coleman, Professor of Geology, School of Practical Science, Toronto, Ont.

J. W. Tyrrell, Civil & Mining Engineer, Hamilton, Ont.

Chas. H. Heys, Consulting Chemist, 114 Bay St., Toronto, Ont.

Chas. B. Jackes, Barrister, Toronto, Ont.

Henry Montgomery, M.A., Ph. D., Professor, Trinity College, Toronto, Ont.

Arthur Ferland, Mine Owner, Haileybury, Ont.

AFFILIATED MEMBERS.

School of Practical Science.

The following members of the Engineering Society of the School of Practical Science were affiliated as Student Members of the Canadian Mining Institute :—

Acton, C. S., Toronto.
Banting, E. W., Toronto.
Bates, M., Chatham.
Bissett, G. W., Toronto.
Galt, G., Rossland, B.C.
Hassard, E. J., Mono Mills.
Huber, W., Bracebridge.
Johnson, H. A., Hamilton.
MacKenzie, K. A., Toronto.
Murphy, C. J., St. Catherines.
Purser, R. C., Windsor.
Rolfson, O., Walkerville.
Ryckman, J. H., Hamilton.
Stirrett, G. P., Petrolia.
Pullen, E. F., Oakville.
Thomson, H. P., Toronto.
Chilver, C. A., Walkerville.
Chilver, H. L. Walkerville.
Coates, P. C., Victoria, B.C.
Elder, A. J., Barrie.
Fleck, J. G., Ottawa.
Ingles, C. J., Toronto.
Jackson, E. R., Seaforth.
Laing, P. A., Dundas.
Parke, J., Oil City.
Rutherford, F. N., S. Monaghan
Bryce, R. A., Toronto.
Coulson, C. L., Welland.
Begg, W. A., West Flamboro.
Broadfoot, F. C., Seaforth.
Campbell, W. C., Keene.
McKenzie, D. W., Lochalsh.
Williams, C. G., London.
Edwards, W. M., Iroquois.
Hamilton, J. F., Dunedin.
Plunkett, T. H., Meaford.
Hill, S. M., St. Thomas.

SCRUTINEERS APPOINTED.

On motion, Mr. Obalski, Mr. Frederick Hobart and Mr. S. Dillon-Mills were appointed Scrutineers of the Annual Vote.

AUDITORS RE-ELECTED.

On motion, Messrs. H. W. DeCourtenay and George McDougall were re-elected Anditors.

ANNOUNCEMENT BY TREASURER.

Mr. J. STEVENSON BROWN—I wish to explain that in regard to the lamented death yesterday of our late Secretary, we have this morning telephoned to Ottawa ordering a wreath for his coffin. The wreath will bear the initials of the Institute "C.M.I., 1904" and the design will be the two hammers crossed at the centre.

I wish to say a word with reference to the financial report of last year. No allowance has been made to the Secretary for the payment of help in regard to the re-publication of Volume VI. The sum of two hundred and fifty dollars is placed in these accounts, and I paid it on a telegram from, and under instructions of, the President.

On the motion of Mr. Craig the meeting approved of the appropriation of two hundred and fifty dollars to be applied to the re-publication of Volume VI.

As to the appointment of a successor to the late Mr. Bell, I do not think it is a question that we can very well deal with here, and so I shall make a suggestion which I hope will meet with the approval of this meeting. I have been in close contact with Mr. Bell for the last three or four years and, as there are probably few who knew better the value of the services he rendered to the Institute, I wish to speak in the highest terms of praise of the faithful manner in which he performed his duties, and of the interest which he took in the welfare of the Canadian Mining Institute. It is out of the question that we could appoint a successor at this meeting. The selection of a gentleman to take Mr. Bell's place requires careful consideration ; I therefore beg to suggest that Mr. Coste, on whose judgment we can all rely, and Mr. John E. Hardman, in whom the members of the Institute have much confidence, should be appointed a committee to suggest to the Council a successor to our late Secretary.

The PRESIDENT suggested that Mr. Brown should also act on that committee.

Mr. CRAIG—It would appear to me that as the late Mr. Bell was re-nominated for Secretary, there will have to be an election to fill the vacancy.

The PRESIDENT—According to the By-Laws, six weeks notice must be given of the nomination of a gentleman to fill the office. That being the case, of course we could not elect a Secretary at this meeting. It seems to me that the best thing to do would be to vote on Mr. Bell's name this year as it is printed on the ballot paper, and then, that the Council shall appoint an acting Secretary pro tem. Then a new Secretary could be elected next year.

Mr. BROWN—I was under the impression that there was a a clause in our By-Laws providing that in the event of the death or removal of one of our officers, the vacancy could be filled by the Council. That is done in a great many similar bodies, but there

is no provision for it in connection with our Institute. The Council could name an acting Secretary, and at the next annual meeting a Secretary would be elected. It is clear that we cannot elect a Secretary now and the arrangement suggested is apparently the only one that can be arrived at.

Mr. CLARK, K.C.—The By-Laws are very clear that the Secretary is to hold office until he is elected at the annual meeting. It is, I think, within the scope of this meeting to appoint a person to act temporarily until the office is filled in the regular way.

On the motion of Mr. Ingall it was decided that it should be left to the Council to select a Secretary to act for the time being.

The meeting adjourned at one o'clock.

WEDNESDAY AFTERNOON.

The members of the Institute met at half-past two o'clock. Mr. Coste, the President, in the Chair.

The PRESIDENT—Before proceeeding with the business of the meetings, I am extremely sorry to have to refer to the irreparable loss we have sustained in the death of our Secretary, who for so long a time was the soul and life of all these meetings. For many years Mr. Bell has been identified with the mining interests of Canada, and he has rendered them valuable service. You know how well he was liked by every one with whom he came in contact, and how much we shall miss him in the future.

The President then read a letter from Col. Anderson, the President of the Canadian Society of Civil Engineers, expressing the sorrow of that Society at learning of Mr. Bell's death.

Mr. J. STEVENSON BROWN—I do not know that I can add anything to what Mr. Coste has already said as to the great loss which this Institute has sustained in the death of our late Secretary, Mr. Bell. He was beloved by us all for his sterling, manly qualities. He did what he believed to be best in the interest of this Institute, and, although he was a hard fighter, he had the respect and esteem of those who were sometimes opposed to his views. Mr. Bell expressed his views freely *in* the meetings and *out* of the meetings. He always acted in a generous spirit of fair play, and his conduct was always calculated to advance the interest of this Institute and of the mining industry in Canada. I have been very closely connected with Mr. Bell, during the last four years, in the office I have the honor to hold, and I can truly say that we will have to seek far and wide to find a man who will discharge the duties of the position of secretary so well as he did. I shall not dwell upon the subject, because my heart is too full of grief, but I will move the following resolution :

Resolved—That the Canadian Mining Institute, in Annual Convention assembled, records its profound regret and sorrow at the untimely death of its Secretary, Mr. B. T. A. Bell. That we testify to the great value of the work he has accomplished in the interest, not only of this Institute, but of the whole mining community, and to his untiring energy and zeal in furthering the objects of the Institute, whose welfare he had so much at heart. The officers and members desire to express to Mrs. Bell and family, their deep sympathy in their sad bereavement.

That a copy of this resolution be forwarded to Mrs. Bell.

Proposed by J. STEVENSON BROWN,

Seconded by W. G. MILLER.

Professor MILLER—Our President and Mr. Brown have so well expressed the feeling of the Institute at the great loss we have sustained, that it is unnecessary for me to do anything further than to second this resolution.

Mr. OBALSKI—As representing the mining community of the Province of Quebec, I wish to bear testimony to the high character of our friend the late Mr. Bell. I have been connected with Mr. Bell for many years, and I know the interest he took in the mining business of Canada, and the valuable services which he rendered to this Institute. I express the sorrow and the deep regret of all the mining community of the Province of Quebec.

The resolution was unanimously adopted and it was resolved that it be forwarded to the family of the late Mr. Bell.

THE PRESIDENT'S ADDRESS.

The PRESIDENT, Mr. Eugene Coste, then presented his annual address. Mr. Coste, in rising to address the meeting, was greeted with warm applause. His address is printed in full in another column. On the motion of Professor Miller, seconded by Mr. Obalski, the thanks of the Institute were accorded to the President for his able address.

WEDNESDAY NIGHT SESSION.

Mr. COSTE having left, accompanied by Mr. J. Stevenson Brown, to attend the funeral of the late Mr. Bell at Ottawa, the chair was taken by Professor Miller.

Mr. R. W. BROCK of Kingston, Ontario read a most interesting paper on "Poplar Creek and other New Goldfields of the Lardeau District, B.C." The paper was illustrated by lantern views and led to an interesting discussion.

The paper by Mr. W. E. H. Carter, M.E., Toronto, On the "Mines of Ontario" was read by Dr. Barlow and was also illustrated by lantern slides.

The CHAIRMAN regretted that a number of gentlemen of the Sudbury District were not present, owing to the snow blockade on the railways. Had they been able to attend he was sure they would have contributed valuable information to the discussion.

Dr. W. A. PARKS of Toronto read his paper on the "Study of Stratigraphy."

Mr. S. DILLON-MILLS, Toronto, read an interesting paper on "Recent Rock Movements in the Laurentian."

The CHAIRMAN announced that the reading of students' papers would take up the session on to-morrow, Thursday, morning. He said : "Our late Secretary who was a great friend of the students, frequently said that in the students' competition some of the very best papers had been presented that had ever been printed among the publications of the Institute."

THURSDAY MORNING SESSION.

The members of the Institute met on Thursday morning at half past nine o'clock, when the reading of papers by students was proceeded with.

Mr. J. F. HAMILTON of the School of Practical Science, Toronto, read a carefully prepared paper on "The Relative Attraction of Different Minerals For Residuum Oil."

On the invitation of the Chairman, Professor Miller, Mr. Hamilton illustrated on the blackboard the different attractions for oil. The paper was discussed by Prof. Miller, Prof. Mickle, Dr. Walker, Dr. Porter and Dr. Adams.

Mr. T. H. PLUNKETT of the School of Practical Science, Toronto, read a paper on the "Rate of Solution of Gold in Potassium Cyanide." The paper was discussed by Mr. Thompson, of B.C., Dr. Porter, of Montreal, and by the Chairman.

Mr. T. W. CAVERS, School of Mining, Kingston, read a paper on "The Treatment of the Dry Ores of the Slocan District." Mr. Cavers illustrated on the blackboard the results of the tests giving the extraction by the different methods.

The paper was discussed by Prof. Mickle, Prof. Kirkpatrick, Dr. Porter and Mr. Gwillim.

Mr. C. W. KNIGHT, of the School of Mining, Kingston, read an interesting paper on "Notes on some Deposits in the Eastern Ontario Goldfield."

The paper was discussed by the Chairman (Prof. Miller), Prof. Mickle, Mr. S. Dillon-Mills, Mr. Baker and others.

There was no session of the Institute on Thursday afternoon, out of respect to the memory of the late Mr. Bell, whose funeral was taking place in Ottawa.

On Thursday night the members of the Institute re-assembled, Prof. Miller in the Chair.

Mr. J. OBALSKI, Inspector of Mines for Quebec, in a paper on minerals containing radium in that Province, pointed out that so far uranium ores are the only ores in which radium has been found. In the Laurentian formations the uraninite, composed of oxide of uranium and other rare metals, had been met with in pegmatite dykes, which have been operated as producers of white mica, and we had only the record in the Villeneuve mine in Ottawa County, with manazite and uraninite, and the Maisonneuve mine in the County of Berthier, with samarskite, although there are several other white mica mines and prospects in the Saguenay district. About ten years ago he had found, in a white mica mine operated by the Canadian Mica Company, a remarkable specimen which he had identified as "cleveite" and exhibited to the Institute. This specimen has a specific gravity of 8.43, and weighs 375 grains, or about twelve ounces. It is well crystallized in dodecahedron form, deriving this from the isometric system. A complete analysis has not yet been made, but it contains 70.71 per cent. of oxide of uranium. He experimented with the specimen, and found it strongly affected photo plates, as shown by a number of radiographs which he displayed. It had also a well marked action on the electroscope. Prof. Rutherford of McGill, found that its radio-activity was equal to four or five times that of the crystal if it had been entirely compounded of uranium, and that it contained one-tenth of a milligram of radium, making it comparable with the best pitchblende so far worked for radium. This crystal may be an accidental one, although he found other small pieces of the same mineral in this vein. Mr. Obalski found also a material like coke, burning quite easily and having a large proportion of ashes, containing oxide of uranium. He was not able to state what was the relation between the two specimens, but he thought the fact important, and proposed to make a further investigation next summer. The white mica vein where these two specimens were obtained is near Lake Pied des Monts, about 18 miles back of Murray Bay in Charlevoix County, Quebec.

Dr. McLENNAN, of the University of Toronto, who has devoted much attention to the study of uranium, said that it was interesting to learn that such ores had been located in this country. He suggested that the exploring parties in different parts of the country next summer should be provided with testing apparatus, which could be made quite inexpensively, but of great sensitiveness. He mentioned the metals with which he had been working, and added that by passing air through crude petroleum he had obtained a highly radio-active gas. In reply to Prof. Miller, he said that so far the only economic use of radium was in medicine, though he was not very familiar with that subject. He, however, informed the Institute that Prof. Currie of Paris had been forbidden to obtain any more of the ore from Austria, as owing to the great value of radium, an embargo was put on the ore and he was unable now to produce good radium. The professor was now looking elsewhere, and would be glad to get such ores from Ontario or Quebec. Dr. McLennan suggested that the Government should give a bounty for the discovery of the ore.

Mr. E. L. FRALECK, of Belleville, said that white mica had also been found north of Cloyne, in Frontenac County; at Oak Lake, Peterboro County, and in Sheffield Township, near Tweed; —all in eastern Ontario, in addition to the places mentioned in Quebec by Mr. Obalski.

Professor MILLER said that even more remarkable than the "cleveite" was the specimen of coal. When the discovery of coal was announeed in Northern Ontario some papers ridiculed geologists for having declared it was impossible to find coal in such formations. If the coal there was not of the usual quality for consumption it might contain qualities which would make it valuable for other purposes. The white mica deposits in eastern Ontario would be explored this summer by an electric company, which hitherto had been obliged to import from India.

Hon. E. J. DAVIS, Commissioner of Crown Lands, at the invitation of the President, briefly addressed the meeting. Mr. Davis was warmly applauded on rising, and said: He recalled that after assuming office he had attended a meeting at Sudbury to get the benefit of practical advice. The discussion had been frank. (Laughter). He had asked for it and his wishes had been complied with. (Laughter). In accordance with a unanimous desire he had abolished royalties, and again after the Act was changed he had, in accordance with their request, left it alone. He hoped to be present to hear the paper by President Coste on "Suggested Improvements in the Mining Laws of Canada," because he desired to have the knowledge of practical men in making legislation and in administering the laws. Having welcomed those from the other provinces, he referred to the good work done by Prof. Miller, Dr. Coleman, Mr. Archibald Blue, and Mr. T. W. Gibson, the present Director of Mines.

Professor COLEMAN read a paper prepared by Mr. A. B. Willmott, which pointed out that for the past few years, there has been considerable discussion on Ontario iron ores. The geological similarity between certain belts in Ontario and those south of Lake Superior had been recognized. It has been claimed, especially in old reports, that Ontario and Quebec abounded in ore, of the first quality. The politicians said so. Yet the Hamilton, Soo and Midland furnaces have only one large producer on which to draw to-day. In 1902, these furnaces consumed 93,000 tons of Ontario ore and 94,000 tons of foreign. Still he thought that the politicians would prove right, and that the lack of ore bodies is because they were not sought in the right way. The paper proceeds to describe surface indications on iron ranges running from the Lake of the Woods to the Ottawa River, and suggested methods to be followed in making systematic exploration. Such work on the Steep Rock, Animikie, Michipticoten and Hutton ranges has resulted in the discovery of ore bodies, but the amount of work done in Ontario on all the ranges put together is trifling compared with that done on the Vermillion range alone, south of Lake Superior between Tower and Ely, a distance of only twenty miles. The time has gone by for running through the woods with a canoe and pick. Iron ranges in large numbers have been found. The question is, what is in the bottom of them?

One of the most interesting of the papers read at the meeting was that presented by Mr. F. T. Snyder, of Chicago, on "Magnetic Separation." This paper was discussed by Mr. Craig, Mr. Obalski, Dr. Potter, Dr. Barlow, Mr. Baker and Mr. Thompson.

The Meeting adjourned at 11 o'clock until Friday morning.

FRIDAY MORNING SESSION.

The members of the Institute assembled at half past ten o'clock Friday morning. The meeting was presided over by the President, Mr. Coste, who had returned from Ottawa, accompanied by Mr. J. E. Hardman, Major Leckie, and Mr. Stevenson Brown.

The morning session of the Institute was devoted to the reading of papers by students.

Mr. E. T. CORKILL, School of Mining, Kingston, read his paper on "The Occurrences, Production and Uses of Mica."

The paper of Mr. H. Forbes, McGill University, on "Chlorination at North Brookfield, N.S," was read by Dr. Porter.

The paper by Mr. Atkinson, McGill University on "Notes on Mining in the Regent Group of Mines, Negaunee, Michigan," was read by Mr. Deyell.

The paper by Mr. E. J. Carlyle, of McGill University, on "Pioneer Iron Mine, Ely, Minnesota," was also read by Dr. Porter.

FRIDAY AFTERNOON SESSION.

The meeting opened at 3 p.m. The President announced that the funeral of the late Secretary, Mr. Bell, had been very largely attended in Ottawa, showing the esteem in which he was held by the community. The Rev. Dr. Barclay of Montreal conducted a most impressive service, and the Quebec Mining Association was represented by Mr. Archibald W. Stevenson.

The paper by Mr. A. C. Garde, on "Notes on the Zinc Problem in British Columbia," was read by Professor Gwillim.

Professor MILLER, Provincial Geologist, Ontario, read his paper on the "Undeveloped Mineral Resources of Ontario." He said in the course of his address that in ten years the product of Ontario had doubled in value. Glacial action had carried the richest soil from Ontario to tracts south of the boundary line, but this was compensated for by the ore bearing rocks thus exposed for the miner.

The old text books taught that it was only in the Huronian rocks that minerals could be found, and that the Laurentians must be considered of little economic value. Prospectors have disproved all that, for, in the Laurentian granites have been found mica, muscovite, corundum and a number of other rare minerals. This gave hope for a mineral development in Ontario far in advance of anything hitherto believed possible. It was now recognized that the Laurentian series of rocks was as rich, or richer, than the Huronian strata in mineral deposits, and the Laurentian granite areas were assuming great economic importance. Stock jobbing had greatly injured the development of Ontario's mining resources. Professor Miller instanced a case in which the most promising gold deposit in Ontario, discovered by Mr. Coste, 21 years ago, was still lying idle because the owners thought they could develop it at someone's else expense. Differences among the shareholders have kept the only platinum mine in the province lying dormant since its discovery 15 years ago. The only iron mine working was due to its favorable location. Iron, nickel and cobalt, distinguished by their magnetic qualities, found together in such quantities, suggested that their concentration was due to magnetic influences or to the antiquity of the rocks of this region. Ontario had only one rival in nickel, and if present promise was fulfilled, she would control the cobalt market, in which no other country could compete.

Prof. Miller referred to the grinding and polishing minerals, graphite, corundum and to the presence of opaque sapphire, ruby and beryl. Prof. Hobbes, of Chicago, had found diamonds in the glacial drift south of the boundary, and there was good reason to believe that diamonds will be found in northern Ontario. If the sulphur could be collected which is wasted in the smelting of 1,200 tons of nickel, it would be worth $3,000 a day. Oil and gas are likely to be discovered in the north, the geological conditions there being the same as in the districts already exploited, but on a much larger scale.

Dr. McLENNAN, of the University of Toronto, displayed a small quantity of radium and showed the Institute its marvellous properties. With the specimen crystal picked up by Mr. Obalski, north of Murray Bay, he discharged an electroscope, showing that it possessed the radio-activity. He then exhibited a small and inexpensive electroscope, which he had constructed, and which could easily be carried by a prospector. Dr. McLennan received the hearty thanks of the Institute.

FRIDAY EVENING SESSION.

MR. COSTE, the President, in the chair.

RESULTS OF ELECTION.

The Scrutineers reported the result of the Annual Ballot as follows :—

"The Scrutineers appointed to open the ballot box and count the votes cast for officers of the Institute beg to report that :

Three ballots, which were unsigned, were rejected; the remaining ballots were all for the names presented by the Nominating Committee. The Scrutineers therefore report, the officers elected for the year 1904-1905 were :—

President, Mr. Eugene Coste, E. M., Toronto.
Vice-President, Mr. E. B. Kirby, M. E., Rossland, B.C.
Treasurer, Mr. J. Stevenson Brown, Montreal.
Secretary, the late Mr. B. T. A. Bell, Ottawa.

Council Members :—

James McEvoy, Fernie, B.C.
W. F. Robertson, Victoria, B.C.
A. B. W. Hodges, Granby, B.C.
W. G. Miller, Toronto, Ont.
R. G. Leckie, Sudbury, Ont.
John Blue, Eustis, Que.
Frank D. Adams, Montreal, Que.
Graham Fraser, North Sydney, C.B.

Respectfully submitted,

Frederick Hobart,
J. Obalski,
S. Dillon-Mills,
} Scrutineers.

Professor T. L. WALKER, of Toronto, in a paper upon "The Geological Survey as an Educational Institution," urged that there should be more co-operation with high schools and colleges in the practical training of geologists. A discussion followed, after which on the motion of Mr. Craig, seconded by Mr. Clark, K.C., it was RESOLVED :—

"That the President, Major Leckie, J. Stevenson Brown, Dr. F. Adams, Prof. R. W. Brock, T. L. Walker and B. A. C. Craig, be a committee to confer with the Minister of the Interior, and the heads of the Provincial Mining Bureaus, on the necessity of giving preference to geological students when making up geological survey parties ; and that the committee also point out the necessity that the Minister of the Interior and the Provincial Governments should take steps to maintain the efficiency and increase the size of the permanent Geological staff."

Mr. COSTE then vacated the Chair in favor of Mr. J. Steven-

son Brown, in order to read his paper on "Suggested Improvements in the Mining Laws of Canada."

Mr. COSTE reviewed the laws in force in the various provinces and objected to the position of the Dominion, which governed by regulations emanating from Orders in Council, a more permanent method was desiriable. The *results* of the present laws were their greatest condemnation. Out of 400,000 acres granted in Ontario under patent since 1897, only 4,000 acres were being worked. At least another 400,000 acres had been granted previously to 1897, so that only one half of one per cent. of the land granted for mining purposes was being developed. There remained in Ontario only a million acres of mineral lands, and at the present rate these would be exhausted in 15 years. To rely on the self interest of the owners for the development of the lands had been shown by experience to be useless. The chances were 2,000 to 1 against development of lands whose value was unknown, but amongst which were almost all the good mines.

His remedy had been accepted, in principle, by all the provinces and consisted of imposing an assessment *in work*, of about $5 per acre, from holders of mining lands ; failure to comply with this condition forfeited the lands to the Crown, unless an equivalent amount in cash be paid within one month of the end of the year. In the Yukon, $200 an acre was the requirement. In Nova Scotia 40 days labor per area (four-fifths of an acre) was required, equal to $200 per year. Mr. Coste thought a $5 assessment would be one of the greatest boons to the bona fide mining community since it would tend to eliminate the drones and stimulate the exertions of the busy bees.

Mr. COSTE'S proposals were supported by Major Leckie and others, and strenuously opposed by Mr. Gibson and others, resulting in a very animated discussion, which did not terminate until near midnight, when the meeting for 1904 was concluded.

CANADIAN MINING INSTITUTE

Annual Meeting, 1904—Presidential Address.

GENTLEMEN :

It becomes my pleasant duty, as President of the Canadian Mining Institute, to welcome you all to this our 6th annual meeting, and, personally, permit me to greet you all the more heartily as this is the first meeting of this Institute to take place in my native Province of Ontario. In past years we have held our annual meetings in the good old City of Montreal, which, by the special Act of Parliament incorporating our Institute, is designated as the place for our head office. Royal times did we have there and good lively discussions on many very interesting topics concerning our mining industries. But we propose here in Toronto to lag behind, neither in contentment and good fellowship among ourselves, nor in the sharp interest always shown in the papers presented by our members. The only fear we have is that our discussions on matters affecting our mining industries will not be as lively here, outside of the French-Canadian invigorating atmosphere. This would be a pity, but it, however, remains to be seen whether it will be so, and we can tell better after the meeting whether our fears in this respect were correct, or whether mining men, especially Canadians, are not always lively wherever they may be.

When this Institute was founded in 1898, it numbered sixty-six members from Quebec, and forty-four from Ontario, exclusive of student members, whilst at the end of last year our record shows sixty-nine members from Quebec, and one hundred and eight from Ontario, exclusive of student members. To this much quicker and larger growth of membership in Ontario, is to be attributed in a great measure the fact that we are gathering in Toronto to-day ; and it is an indication that the mining centre of Canada is becoming fashionable and is preparing to move west and north, as further exemplified by the fact that we have now eleven members in the Yukon, while we had none there in 1898, and that we have now sixty-eight members in British Columbia, when we had only forty-two there in 1898. It is true, as an offset, that we have now from Nova Scotia thirty members instead of sixteen in 1898, but still it is clear that our Quebec and Maritime Province membership is (in point of number only) lagging behind the membership west of Montreal. No doubt this is only a natural result of the opening up of the western section of the country, but still I thought that by mentioning the fact I might nevertheless stimulate our eastern members to renewed efforts in getting all the good mining engineers and mining men in their provinces to join our Institute, in order to make it a still more powerful factor in carrying out the purposes, for which it was chartered by a special Act of the Parliament of Canada. These purposes are well defined in the preamble of our Charter, they are unselfish and noble purposes ; and since this is our first meeting outside of Montreal, it seems a good opportunity to review briefly the past work of our Institute, as this review will show that we are living up to the patriotic, unselfish aims for which we got together some years ago, and are thereby greatly benefitting and promoting the development of the mining industries of Canada.

A little of the past history of the several mining organizations which preceded us is here necessary, since we are the successors of these bodies of mining men formerly organized separately in the different mining provinces, but which afterwards not only formed a federation, but even dissolved themselves subsequently into a larger and stronger Institute under a general Charter from the Canadian Parliament to embrace mining engineers and mining men from the whole of the Dominion of Canada.

The following is a brief sketch of the evolution of these mining associations :—

January 23rd, 1891—General Mining Association, Province of Quebec, was formed.

March 30th, 1892—Mining Society of Nova Scotia was formed.

April 10th, 1894—Ontario Mining Institute was formed.

January, 1896—Federated Canadian Mining Institute was formed.

March 4th, 1898—Canadian Mining Institute was formed.

Before the organization of the Quebec Mining Association there was a small organization in Nova Scotia called The Gold-Miners Association of Nova Scotia, of which our present worthy secretary was the only honorary member. We must not overlook the Mica Miners Association, which did some good work in collecting a large amount of data concerning the production, uses and markets for mica, nor the organization effected last year of the Provincial Mining Association of British Columbia, a very well organized body of all classes of the community in that Province, organized for protection, and the betterment of mining legislation in British Columbia.

All these organizations have been a powerful factor for good. First through their publications :—

A list of the papers read before these bodies forms quite an imposing and exceedingly creditable conribution to our mining literature ; they, and the discussions upon them have been published in pamphlets and handsome volumes, and have rendered an impor-

tant service to the country in advertising our mineral resources and industries. This list of papers is printed in a separate pamphlet, already before you. A glance at it will illustrate the great diversity of the subjects treated, that is almost to say the great richness of Canada's various mining resources; and a careful reading of the papers will convince one of the great value of this literature to the country.

I will only add here that, if a comparison is made between the publications of the Canadian Mining Institute, as shown at the end of the appended list, and the publications of "The Institution of Mining Engineers" of England, or of "The American Institute of Mining Engineers", it will be found that, relatively per capita of members, our papers are considerably more numerous and, as to their worth, we are of course too modest to speak, and leave it to others but with confidence in the verdict.

Thus we see that the first object and purpose of this Institute as set down in our charter, viz :— "To promote the arts and sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers and the subsequent distribution of such information as may be gained, through the medium of publications", is very creditably carried out by the Institute. But if, in the short space of time of six years since the incorporation of the Institute, we have made such an excellent showing in the matter of publications, it is still more pleasing for me to record that these publications are improving very rapidly from year to year and that the last two volumes of our Journal, volumes V and VI, contain many more papers of a still higher and useful class than the preceding volumes, and that they are well and profusely illustrated.

I take renewed pleasure here in again recording and acknowledging with thanks, as President of the Institute, the generous assistance of the Dominion Government in granting us three thousand dollars per year during the last two years towards defraying the expenses of these publications and of the Institute in general. Thus the Government has recognized our Institute as of public utility, and has facilitated its growth and influence. In doing so, it has no doubt rendered a great public service to the country, as the mining engineers and mining men of Canada together in a chartered strong organization can do so much to make known, develop, utilize and protect its great mineral wealth, and the Canadian Mining Institute composed of such men has shown and will continue to prove, that it can be of the greatest service in these most important undertakings.

But not only by the publication of technical papers read at its meetings can an Institute such as ours be of service to the country, but the Canadian Mining Institute as a body has still another very important mission to perform, and that is also defined in its Charter as one of the purposes for which it was founded, thus, namely :— "to take concerted action upon such matters as affect the mining and metallurgical industries of the Dominion of Canada."

This mission is all the more important that we are practically alone entrusted with it in Canada, since with the exception of the Mining Society of Nova Scotia and of the Provincial Mining Association of British Columbia, we are the only organized and incorporated body of mining engineers and mining men in the country, and of course the above Provincial Associations only represent their provinces in matters purely local, while the Canadian Mining Institute alone represents the mining interests of the entire Dominion of Canada, not excepting Nova Scotia or British Columbia, as almost every member of the above mentioned Provincial Associations is also a member of our Institute.

In the matter of the publication of technical papers we are sharing the duty and responsibility with other societies and with such Government institutions as the Geological Survey and the Provincial Mining Bureaus, but in all matters affecting the welfare of the material interests so dear to us of the mining and metallurgical industries, we repeat, this Institution is, in a very large measure, alone to raise a competent voice and to give authorative advice.

This protective mission or duty which, naturally and by its Charter, devolves upon this Institute, was in fact the reason for its foundation, as the first movement to form what is now the Canadian Mining Institute was prompted by the introduction of the Mercier Mining Act in Quebec to oppose which the Quebec Mining Association, our first parent, was organized early in 1891.

In looking over the report of one of the first meetings, held in this connection at the St. Lawrence Hall, Montreal, in October, 1890, we notice these significant remarks from one I need not introduce.

The then Hon., now Sir, Wilfrid Laurier having been called upon by the Chairman said :—" He had just dropped in to listen, and had no intention of making a speech. He was personally interested in mining operations in the Province, and although he would not go so far as to say that after mines had reached a certain stage of development they should not be made to yield some public revenue, still he felt that to impose any new burden upon what was yet a new industry would not only be detrimental but fatal (Cheers). He deprecated the introduction of politics into the matter. He need not tell them that he was a supporter of Mr. Mercier (Laughter and Applause), but he was nevertheless ready to join those present in demanding that an industry in which he was to some extent interested should be safeguarded. He fully believed that when the bearings of the subject were placed fairly and justly before the Government they would shrink from the adoption of legislation injurious to the interest of the Province."

In the above language of our distinguished Premier, we must ever be ready to safeguard the best interest of the industries in which we are vitally concerned by fairly and justly placing before our Government all the bearings of the different subjects arising in respect of these industries, and, in doing so, we are only abiding by and fulfilling the provisions of our Charter of Incorporation. Have we done so in the past and what is the record of the Institute in that respect?

In the Appendix to this address will be found a list of all the discussions, resolutions and actions of the Institute on matters affecting the mining and metallurgical industries of the country as these took place from year to year. It is not a very long list, not as long as the list of our papers, as we are of course much more interested in technical matters during our annual meetings, but a study of it and a careful reading of all the discussions clearly shows that we have nevertheless been alive to the safeguarding of the best interests of the industries we represent, and according to the precept of our Right Honourable Premier in the language above quoted, by presenting our cases fairly and justly. The very best proof indeed of the constant justice and fairness of our course is that almost every recommendation made by this Institute has been adopted by our different Provincial Governments or by the Dominion Government. For instance in the three following important matters :—

First.—As this Institute strongly advocated, export duties on nickel-copper ores and mattes or on any other mineral were never imposed by the Dominion Government notwithstanding that this was advocated by many in the press and everywhere, and even was asked of the Dominion Government in an Order-in-Council

approved by the Lieutenant-Governor of Ontario on the 24th November, 1899.

Second—Notwithstanding that a law was passed in the Ontario Legislature in the session of 1900 empowering the Lieutenant-Governor in Council to impose, by proclamation, certain heavy taxes on nickel and nickel-copper ores and mattes and to remit these taxes in cases in which these ores or mattes were completely refined in Canada, yet the provisions of this bill were never proclaimed in force, and time has shown that the members of this Institute were on the just and right side in opposing strongly such an interference with the industrial independence of the mining community.

Third.—And again the Yukon royalty of 10% on the gross gold production, imposed by the Dominion Government, has been reduced to a 2½% royalty now collected on the gold exported, as strongly recommended by us in one of our memorials to the Government.

The above are our most important victories, but our influence has also contributed largely to many lesser achievements such as the successive defeats of a well known bill, brought forward with persistence year after year, and which we as persistently opposed because we considered that it would restrict and confine the practice of engineering within certain limits altogether too narrow; also the defeat of the Alien Labor Law in British Columbia and of the Eight Hour Law in the same Province. To this influence of the Institnte and to our discussion on these matters is also due in no small degree the making of good roads in the Yukon, many improvements in the mining regulations of that district, the exemption of municipal taxation for the mineral properties of Quebec Province for another period of 10 years from 1899, the placing on the free list of gold dredging and other mining machinery, etc., etc.

There is also another subject of very great importance to the mining interests of this country to which this Institute has wisely devoted considerable time and attention on many occasions and in which, I am very glad to be able to record, our influence has also been the means of effecting substantial advance and progress. I refer to the question of what should the Dominion Government do in "Aid to Mining."

So far the Geological Survey of Canada has been almost the only "Aid to Mining" given by the Dominion Government. This Institute has always shown its appreciation of the good work of many prominent members of the Geological Survey, and has even advocated with some success, the payment of larger salaries to members of such a technical branch of the service. It has also often recommended larger, better and safer accommodations for the offices of the Survey and for the very valuable collections of its museum, and it is very gratifying to know that this is at last being provided for in an entirely new large building, the ground for which has been acquired by the Government in Ottawa and the plans of which have been prepared and decided on, and which is to be built immediately. Yet this Institute has felt and has fairly but firmly expressed during the important and lengthy discussions which took place on this subject during our annual meeting of 1902, that the Geological Survey as then organized and conducted, was entirely unable to cover all the ground which the "National Importance of Mining" and the many important interests served thereby, now need and demand in such a large and rapidly growing country as Canada, so rich in mineral resources of all kinds and so much of which is yet so entirely new and even unknown that it requires many thorough explorations, surveys and studies. We pointed out that the Geological Survey Department in charge of this work had not grown with the country, that it had practically the same appropriation year after year for many years, and, therefore, that it was only natural if it was not keeping pace with the rapid mining and metallurgical developments of this country, and if it was lacking in many of the branches necessary for its complete usefulness. That it needed therefore to be reorganized and extended and converted into a "Department of Mines and Geological Survey".

At the end of the discussions, which should be carefully read in our Volume 5 by all who take an interest in the development of our mineral resources, it was unanimously resolved:—"That the Canadian Mining Institute, in annual session assembled, desire to direct the attention of the Federal Government to the magnitude and importance of our mining industry which, during recent years, has developed so rapidly; and respectfully urges an increase of Government aid wherever possible, and the establishment of a strong and practical Department of Mines, or of a Department which shall be devoted to the interests of the mining and metallurgical industries, and which shall include the Geological Survey and all other necessary branches."

These necessary branches were clearly pointed out during the discussions to be:—

Administrative branch.
Geological Survey, Paleontological and Botanical branch.
Geographical and Topographical branch.
Mining, Geological Survey and Monograph branch.
Statistical, Economic and Commercial Mining branch.
Chemical and Metallurgical branch.

I take pleasure in recording that the Dominion Government, through the Honourable the Minister of the Interior, has been gradually working on the lines of the above resolution and suggestions, and in complimenting the new geographical branch on the excellence of its work newly published, and we have no doubt that the other branches which have newly been or are being, organized will soon be able to make as creditable a showing.

This is the age of specialization, as we all know, and necessarily so since every branch of science, industry, commerce, or anything else, is getting to be such a vast and complex subject in itself, that the best specialists are often none too good to stand the sharp light and competition of such rapidly advancing progress. Therefore, it is only natural that the conclusions arrived at by members of this Institute, after exhaustive studies and discussions on the subject of "Government Aid to Mining", should have been that the work of the department of the Dominion Government specially devoted to the interests of the mining and metallurgical industries of the country should be specialized in different branches, each with as competent a head as it is possible to secure and all under the direction of one of our cabinet ministers; whether this cabinet minister be named Minister of Mines or Minister of the Interior, is a matter of little moment to us as long as the important work under his charge, in which we are vitally interested, is thoroughly and systematically done.

The work of such a department of the Dominion Government, as it was well pointed out during our discussions, would not interfere in the least with the mining rights, and the work in that connection, of our different Provinces, which have under their charge the making and administration of the mining laws of these Provinces; the selling thereby or leasing of the mineral lands; the inspection of the mines for the due protection of the safety of the miners and the prevention of waste; the keeping of proper maps, plans and records of their mines; the collection of dues, licenses, taxes or royalties on the mines of their Provinces; the collection of mineral and metallurgical statistics; the care of helping and

fostering technical education ; the Provincial public assay offices ; the making of better roads and other means of transportation in their mining districts ; the establishment of custom concentration and reduction of works ; the assistance in deep sinking or in testing deposits by diamond drills or otherwise ; the prompt issuance of notes, papers or bulletins on the newly discovered mineral districts of the Provinces, etc., etc.

There is only one more question of importance which has engaged the attention of our Institute especially at our last annual meeting which I need to record here to make this review complete, and that is the subject of mineral statistics.

This Institute has naturally always attached the greatest importance to a thorough statistical knowledge of the progress of our mining and allied industries from year to year, and many presentations of such statistics, and discussions upon them, have taken place at our meetings. From all of which it is quite clear that the correctness of such records, their prompt publication, their fullness and their clearness, is as apparent to us and to the success of our mining and allied industries as a true compass is to a navigator ; in fact as entirely indispensable to us as the needle is to that navigator. But, unfortunately, the mining bureaus of the different Provinces and of the Geological Survey, who collect and publish these statistical records for their Provinces and for the Dominion respectively, have adopted widely different standards of value, and even different systems of compilation and presentation, which have so far rendered these records of very much less practical value to the members of this Institute, and to the important interests of the country to be served thereby as they would otherwise have been ?

Taking this into consideration and after prominently discussing the subject at our last annual meeting we appointed a large committee of our members, including all the heads of the different official mining bureaus of the country, who are all members of our Institute, and who very kindly volunteered to assist our efforts in this direction of uniformity in these records. This committee has been at work and will continue its labor until it is able to report the accomplishment of the important results sought after.

In closing this imperfect review of the work of the Canadian Mining Institute in the past I beg to thank you all, gentlemen, for your kind attention and I will now formally declare the 1904 meeting of the Institute open for the reading of papers and the transaction of business.

APPENDIX.

DISCUSSIONS, RESOLUTIONS AND ACTIONS OF THE CANADIAN MINING INSTITUTE, YEARS 1899 to 1903 INCLUSIVE.

ANNUAL MEETING, MARCH, 1899—A petition respecting Yukon Mining regulations, forwarded to us from the Incorporated London Chamber of Mines and asking the help of this Institute in obtaining a number of changes in these regulations, especially with regard to the 10% royalty, was considered ; but, as the Secretary of the Institute stated that the Dominion Government had emphatically declared at that time that they would not make any rebate of that royalty, it was agreed that nothing could be done by the Institute at that time.

Discussion on the work of the Geological Survey, and resolution declaring appreciation of the services rendered to the mining interests of Canada by the work of the Geological Survey, and urging upon the Government the necessity of giving further financial support to that department, with a view to the increase of its work in the mining districts, and also of more adequately remunerating the services of the members of its technical staff.

Resolution authorizing the Council of the Institute to impress the Provincial Governments with the necessity of maintaining their mining bureaus in a high state of efficiency and with the desirability of these bureaus adopting a more uniform standard of compilation of mining statistics.

Opposition to a bill of the Canadian Society of Civil Engineers restricting the rights of engineers to practice unless they become members of that society ; and authority conferred on the Council of the Institute to take the necessary steps to defeat the object of this bill in so far as it affects, or relates to, mining interests.

Resolution presented by the British Columbia members urging upon the Dominion Government the desirability of establishing a mint in British Columbia ; postponement of the question for further consideration.

SUMMER MEETING, BRITISH COLUMBIA, 1899—Resolution strongly disapproving of the passing of an eight hour law by the British Columbia Legislature and asking for its repeal.

ANNUAL MEETING, MARCH, 1900—Discussion on mining laws, during which the need of a mining law in the Yukon and other territories of the Dominion was pointed out.

Discussion during which the small size of the placer claims in British Columbia is pointed out and condemned, and during which the very bad results of the alien labor law of British Columbia in the Atlin district are pointed out.

Discussion of the conditions then existing in the Klondike, during which the building of roads in that district is strongly advocated as a necessity for the freer and cheaper transportation of supplies and of mining machinery, and for the good of the district in general.

Discussion on the 10% Dominion Government royalty on the gross output of gold in the Yukon, during which the onerous nature of that royalty is strongly brought out and condemned ; the Institute petitions the Dominion Government for the reduction of that royalty to 2%, for the collection of it on the gold as exported out of the district, and for the collection of correct statistics of the gold production of that district.

Discussion on the nickel question and on export duties, during which many of the members strongly disapproved of an Order-in-Council passed by the Ontario Government (24th November, 1899) asking the Dominion Government to impose export duties on nickel and nickel-copper ores and mattes, and proposing not to grant nickel-copper mining lands, in the future except under a condition providing for the cancellation of the grants in case the nickel and nickel-copper ores and mattes were not refined in the Province ; the meeting referred the matter to the Council with full power to act as it thought best.

ANNUAL MEETING 1901—A delegation of members of the Institute is appointed to urge upon the Government the great need of further accommodations for the museum and offices of the Geological Survey, and also to advise the payment of larger salaries to the technical officers of the Survey in order to retain and secure the services of the best men in the country.

Institute recommends that Dr. F. D. Adams, Logan Professor of Geology at McGill, be appointed sucessor to the late Dr. Geo. M. Dawson as Director of the Geological Survey of Canada.

Discussion on "Company Law", during which the provisions of the "Company Law" of England and of the Dominion to prevent the selling of stock below par are commended.

The secretary of the Institute reports that during the previous year (in April 1900) he and other members of the Institute, on behalf of the Institute, opposed the passage of the following bill introduced in the Legislature of Ontario by the Hon. the Commissioner of Crown Lands, namely : " An Act to Amend the

Mines Act". This Act provided that anyone mining iron ores, zinc ores, copper ores, nickel ores, nickel-copper ores or any other ores or minerals in the Province was to pay, in the future, very heavy taxes on the gross output of these minerals ; these taxes to be remitted at the end of the year to those smelting and refining in Canada ; the metals from these ores that after the strong recommendations made on behalf of the Institute against this Act, it was greatly modified, and all its provisions were struck off in respect to all ores and minerals except nickel and nickel-copper ores and mattes, and finally that an amended bill was passed by the Legislature (63 V. Cap. 13) in which :

First.—The Lieutenant-Governor in Council was authorized to put into force and effect by proclamation certain sections of the bill by which the following very heavy taxes upon the gross output of nickel and nickel-copper ores and mattes would be imposed, namely :—

(a) For ores of nickel $10 per ton, or $60 per ton if partly treated or reduced.

(b) For ores of copper and nickel combined $7 per ton, or $50 per ton if partly treated or reduced.

Second—The Lieutenant-Governor in Council was also authorized to remit or refund these taxes, in part or in full, "where ores or minerals that have been mined, raised, or won in the Province are smelted or otherwise treated in the Dominion of Canada by any process, so as to yield fine metal or any other form of product of such ores or minerals suitable for direct use in the arts without further treatment."

The provisions of the above bill were fortunately never proclaimed into force and effect by the Lieutenant-Governor in Council, thanks to a large extent to the efforts of this Institute.

ANNUAL MEETING, MARCH 1902—The bill of the Canadian Society of Civil Engineers restricting the practice of engineering in Canada to members of their Society, is again before the Institute with some amendments, but after due consideration it is again decided to oppose it, and the Secretary is instructed to wire the Chairmen of the Private Bills Committees of the Ontario and Manitoba Legislatures protesting against the passage of any such legislation:—"Since it gives powers to said Society which should not be given to any one branch or section in the present condition of the engineering profession. Such powers should be retained by the Government itself or reserved for a society or association representative of the whole profession."

A very good discussion took place on "The National Importance of Mining" and how the Government of a country may promote the interests of mining, and the development of its mineral resources. At the end of this discussion the following resolution was adopted:—

That the Canadian Mining Institute in annual session assembled desires to direct the attention of the Federal Government to the magnitude and importance of our mining industry, which during recent years has developed so rapidly ; and respectfully urges an increase of Government aid wherever possible, and the establishment of a strong and practical department of mines, or of a department which shall be devoted to the interests of the mining and metallurgical industries, and which shall include the Geological Survey and all necessary branches.

ANNUAL MEETING, 1903—Discussion on mining statistics and appointment of a committee of the Institute to report at the next annual meeting, and to suggest, if possible, a system of presenting mineral and metallurgical statistics acceptable to all the different Government Mining Bureaus in Canada, in order that complete uniformity be obtained in these important records of the Dominion and of the different Provinces.

After discussion it was resolved that this Institute, through its officers, urge on the Government of the Province of Quebec the necessity and importance of establishing in the city of Montreal a branch office of the Provincial Department of Mines.

Notes on some Special Features of Coal Mining in the Crow's Nest.*

By James McEvoy, Fernie, B. C.

To one familiar with the methods of bituminous coal mining in an Eastern field, the successful management of a colliery in the West is not always an easy task. This is especially the case in the Rocky Mountain coal basins, where he finds himself face to face with conditions requiring considerable modification of his Eastern methods, if not an entirely different system of their own. A knowledge of the causes giving rise to the new conditions, helps him to meet them with intelligence, and to forsee and provide against any new difficulties which may arise.

The geological history of the eastern and western coals, when compared, show similarity if the two factors, "time" and "force" be left out of consideration. The eastern coals are practically all of Carboniferous age. A possible exception to this is in Virginia and Kentucky, where some of the coals may reach as high as the Triassic. Since their deposition they have gradually, at an infinitesimally slow rate of progress, been developed through the various stages from the original peat bed up through the different varieties of lignite to their present bituminous form. It is beyond the knowledge of man to ascertain the length of time which elapsed during this development. There was, generally speaking, little disturbance of the measures, and the beds are found to-day in altitudes more or less closely approximating their original horizontal position.

The western coals are chiefly of Cretaceous formation and consequently are four geological ages younger than the eastern ones. They have gone through all the same stages as the eastern coals, but their development has been accomplished in one half the time. (It may be stated here parenthetically that it still remains, in our modern times, a characteristic of the West to do things in one half the time).

After the deposit of the peat beds all those that are preserved to-day in the form of coal were covered by succeeding layers of clay, sand or gravels, which are now seen in the form of shale, sandstone and conglomerates overlying the coal. The accumulation of a great thickness of these superincumbent strata brought an intense pressure to bear upon the peat beds at the bottom and they were compressed to about one-twelfth of their original thickness. The continuation of this pressure and the consequent heat developed, gradually drove off the excess of moisture and more or less of the volatile constituents. Any movement of the strata resulting from the shrinkage of the earth's crust, naturally increased the pressure and heat and hastened the alteration.

It has been due to greater activity in these earth movements that the western coals have been altered to their present form in so much shorter time.

The Rocky Mountain region in most parts was the scene of tremendous movements, and great pressure is evidenced by the crushing, thrusting, folding, faulting and uplifting of the measures.

The, comparatively speaking, newer rocks, such as the Cretaceous, sometimes suffered equally with the older ones of the region, and some large areas which, under quieter conditions, would have produced valuable coal fields, were crushed and broken and eventually swept away by the denudation of succeeding ages. In other parts the movements were less violent, and where the pressure and heat were sufficient to produce the required degree of alteration of the coal without crushing the main portions of the

* Paper presented at the 6th annual meeting of the Canadian Mining Institute.

basins, some of the highest grade bituminous coals were found in good workable form.

The greater the degree of alteration, the more moisture and volatile matter were driven off, and the higher the percentage of fixed carbon remained. Near the axis of the Rocky Mountains the conditions were most favourable for the development of good coal and the percentage of fixed carbon is generally between 65 p.c. and 78 p.c. Going eastward from the axis of the Rockies, the pressure gradually diminished and the fixed carbon is found to decrease, while there is a corresponding increase in moisture and volatile matter in the coals. Continuing eastward the coals soon become lignitic in character and when the great plains are reached they are represented only by lignites proper.

The Crow's Nest field, situated just west of the main divide, suffered to some extent like the rest of the region. Its edges were turned up and a wider strip, now the Elk River Valley, was broken and carried away by erosion, but the main body of the field was lifted bodily up without any serious distortion. Generally speaking, the measures of the Crow's Nest field as they stand to-day, are bent upward all around the western edge of the field. The bending is almost universally gradual and regular, changing the altitude of the coal seams from horizontal to an extreme pitch of 40° in a distance of about three miles.

At three places on the western edge of the field, tributaries of the Elk River which run partly or entirely across the field have cut out deep valleys, thus making the coal seams accessible by level entries at places where the seams are more or less closely approaching the horizontal position. The highest seams in the main group of coal measures are exposed at points farthest up the valleys and, consequently, they are lying flatter than the lower ones where the latter are exposed by the same streams lower down and nearer to the edge of the basin.

At Morrissey, Fernie and Michel, situated respectively on the three transverse streams before mentioned, the Crow's Nest Pass Coal Company is carrying on active mining operations. At Coal Creek (the oldest of these collieries) the upper seams are lying in altitudes varying from horizontal to a dip of 15°. The lower seams on the same creek dip as high as 20°. At Morrissey the dips vary from 8 degrees to 24 degrees, and at Michel, they run from 15 degrees to 35 degrees.

It is evident that a system of mining and handling the coal in a *flat* seam will not apply to all these cases. Where the dips are moderate, the equipment is simple like that for a flat seam, horses drawing the cars from the working places to the main haulage roads. With the steeper dips, incline planes are used on which gravity does the work of lowering the cars to the main roads. Horses are then only employed on the secondary levels. Rooms are driven up the pitch from the levels and in each room there is a simple self-acting incline, or "McGinty", which is operated by the miners themselves. Where the dip approaches 35 degrees, chutes are used in the rooms and the coal is drawn from these into cars on the levels.

To obtain the greatest economy in handling the coal, the main haulage roads must be carefully laid out to take every advantage of the ground. Incline planes must be so located as to concentrate the work of lowering the cars. For this reason each incline is laid out so that it takes the cars from a set of rooms, 15 to 20 in number, on each side at every successive level. Without a proper system and equipment, the cost of handling the coal in a pitching seam is greater than for a flat one, but these once being installed, the arguments are by no means all in favor of the flat seam.

The physical and chemical properties of the coal depend to some extent upon the amount of cover now overlying the seams, but are affected to a greater extent by the pressure which has been exerted by the bending of the measures and by the manner in which the strata have yielded to the bending movement.

Where the seams are lying flat, or nearly so, assays like the following one, made from a sample specimen of coal from the face of No. 2 Mine, Coal Creek, are usual :—

Moisture	0.41
Volatile matter	24.78
Fixed carbon	68.36
Ash	6.45
	100.

The bodily tilting up of the seams when unaccompanied by bending does not materially affect the constituents, as may be seen from the following assay of an average specimen from the face of the main level of No. 8 Mine, at Michel :—

Moisture	0.99
Volatile Matter	23.64
Fixed Carbon	67.99
Ash	7.38
	100.

The seam on which No. 8 Mine is operated is tilted up to an angle of 30 degrees to 35 degrees without bending.

Where the measures are bent even slightly, if it continues for some distance to either side, there is a noticeable increase in fixed carbon and a corresponding decrease of volatile matter. The resulting coal is rather better in quality, having greater heating power.

An example of this may be taken from No. 4 Mine at Michel, across the valley from No. 8, where the measures are dipping about 15 degrees and where the altitude of the rocks outside shows that there was a slight bending movement ; the assay from No. 4 Mine is as follows :—

Moisture	0.63
Volatile Matter	21.44
Fixed Carbon	73.85
Ash	3.23
Sulphur	.85
	100.

A similar example may be taken from No. 1 Mine at Morrissey where the bending conditions are more pronounced :—

Moisture	0.65
Volatile Matter	13.48
Fixed Carbon	78.88
Ash	6.40
Sulqhur	0.59
	100.

These assays were all made by Mr. R. W. Coulthard.

As regards physical properties of the coal it appears that when the roof and floor have held the coal under intense pressure during the bending movement, the coal remains firm. In some instances, however, this has not been the case and the roof and floor have apparently yielded readily to the induced lateral pressure, allowing the seam to "thicken out". The result is, then, that a certain amount of shearing has taken place and the coal mines freely, producing a higher percentage of slack. This is an advantage rather than otherwise, where so much slack coal is needed for making coke, as it saves the cost of crushing lump coal.

THE CROW'S NEST PASS COAL COMPANY, LTD.

Directors' Report.

(Presented to the shareholders at Toronto, February 12, 1904.)

The Directors beg to submit to the Shareholders of the Company their Seventh Annual Report, including Statement of Assests and Liabilities as of the 31st December, 1903.

The balance at the credit of Profit and Loss Account brought forward from 1902 amounted to $950,511.96. To this has been added the sum of $310 492 28, being the Company's net profits from the operations of the year, also the sum of $913 526.25 representing the premium received on calls paid on new stock ; the whole making an aggregate to the credit of the Profit and Loss Account of $2,174,530.49. From this amount the Directors have paid four dividends of 2½ p. c. each making 10 p. c. for the year, and amounting in all to $303,717.36. This amount deducted from the above balance at the credit of Profit and Loss, leaves at the credit of that account, carried forward to 1904, the sum of $1,870,813.13.

The balance of the new issue of stock referred to in the last Annual Statement as to be paid during the year 1903, amounted to, including the premium, $I 646.318.75. On the 31st December last this had all been paid, with the exception of $123,775.00, (of which $74,265 00 is premium).

Substantial progress was made during the year in the permanent development of the Company's properties at Coal Creek, Michel and Morrisey. It was not until the first of February, 1904, that the mines at Coal Creek, which had been damaged by the explosion of the 22nd May, 1902, were fully restored.

During the year nearly a million dollars have been spent on plant, development and machinery, adding largely to the efficiency and capacity of the mines and of the operating and coking plants.

The steady increase in the production of coal is best illustrated by pointing out, that the output for the year just closed, exceeded that of 1902 by 49.83 p. c., while the output for December, 1903, is larger than that of January of the same year by 58.72 p. c. This satisfactory progress has been made, notwithstanding that production was materially retarded by a strike of all the company's miners, lasting from the 11th February to April 1st, and to a less degree by the strikes of the coke oven men in May, and of the miners at Morrissey in September. A contract has been executed with the men, providing for wages, hours of labor and other usual matters, effective for three years, but determinable by either party at the end of the second year, and it is expected that there will be no more labor troubles during the life of this agreement.

The mountain slide at Frank, which covered up the Canadian Pacific Railway Company's main line in the Crow's Nest Pass, gave rise to a car shortage of considerable duration, as did the handling of the western harvest in the months of October and November, both of which shortages interfered to a considerable extent with the transportation, and therefore with the production of coal and coke.

The Accounting work has been separated from that of the Operating, and a new department created to take care of this and the Purchasing, and Mr. Daniel Davies has been appointed Comptroller in charge of this department.

Mr. T. R. Stockett, jr., is now Acting General Manager and it is hoped that the confidence that his record as General Superintendent for several years has earned for him will be confirmed by his work as Acting General Manager.

The duties formerly performed by the Managing Director have been assigned to the office of the Third Vice-President, and are now being very satisfactorily performed by Mr. G. G. S. Lindsey, who has been elected to that position.

The Directors regret that Mr. R. W. Macpherson, the General Auditor of the Company, will after the Annual Meeting sever his connection with the Company. a loss which will be much felt.

All of which is respectfully submitted.

G. G. S. LINDSEY, Third Vice-President. GEO. A. COX, President.

TORONTO, February 12th, 1904.

PROFIT AND LOSS ACCOUNT, FOR YEAR ENDING 31ST DECEMBER, 1903.

Balance at Credit Dec. 31, 1902	$950,511 96	
Net Profits for 1903	310,492 28	
Premium received on calls paid on new stock	913,526 25	$2,174,530 49
APPROPRIATED AS FOLLOWS:		
Dividends Paid	$ 303,717 36	
Balance carried forward to 1904	1,870,813 13	$2,174,530 49

GENERAL STATEMENT, 31ST DECEMBER, 1903.

ASSETS.

Mines, Real Estate, Plant, Development, etc...		$5,418,435 51
Cash in Banks	$ 66,551 31	
Accounts Receivable	313,660 79	380,212 10
		$5,798,647 61

LIABILITIES.

Capital Stock Paid Up		$3,450,490 00
Bills Payable	$145,000 00	
Accounts Payable	250,265 64	395,265 64
Dividend No. 12, Accrued		82,078 84
Profit and Loss		1,870,813 13
		$5,798,647 61

INDUSTRIAL NOTES.

In our February issue the advertisement of the Riblet Patent Automatic Aerial Tramway stated that one man "can handle 1,200 tons per day." More recent information has shown the capacity of this tramway to be fully one third more, or the sum of 1600 tons per one man in 24 hours. The advertisement has been altered to the above figures.

In the interests of the Kootenay mining district petroleum has been transferred to the free list, by Order-in-Council, when it is imported for the concentration of ores by mine owners or mining companies for use only in concentrating establishments belonging to such mine owners or mining companies.

The Allis-Chalmers Co. advise, by circular, that its already large business is to be expanded. The Company is now associated with the Turbine Advisory Syndicate of England, and is prepared to build steam turbines in units from 500 to 1 000 K. W. for use in the United States, Canada, Mexico and South America. The Company has also acquired licenses and patents which enable it to supply the famous hydraulic machinery of the Swiss firm of Eschen-Wyss & Co., and the gas engines of the German Company known as the Nurnborg Machinery Co., in sizes ranging from 260 H. P. to 6,000 H. P.

The Sullivan Machinery Company, Chicago, reports that owing to the growth of its business, it is making several changes in the addresses of its different offices this spring to secure larger quarters and increased facilities. The New York office, Mr. A. E. Blackwood, Manager, is now located at 42 Broadway, Rooms 1427-28, instead of the Empire Building, 71 Broadway, where it has been located up to this time. On the 1st of April, the Pittsburg office, Mr. Geo. W. Favor, Manager, will move from the Schmidt Building, 339 Fifth Avenue to the Farmers' Bank Building, where it will occupy rooms 1112-13. On or about April 15th, the general offices located heretofore at 135 Adams St. Chicago, will move into the newly completed Railway Exchange Building at the corner of Jackson Blvd. and Michigan Avenue where they will occupy Rooms 1502-14 inclusive.

The Allis-Chalmers Co., announce that their new electrical machinery depart will be in charge of Mr. John F. Kelly and Mr. Wm. Stanley ; both formerly of the Stanley Electric Co.

The announcement is also made that Mr. Philetus W. Gates and Mr. Henry W. Hoyt, respectively General Superintendent and Second Vice President of the Allis-Chalmers Company, are about to retire from active participation in the management of that Company.

Mr. Gates was president and Mr. Hoyt secretary and general manager of Gates Iron Works for fifteen years prior to the incorporation of the Allis-Chalmers Company in 1901. The late P. W. Gates (father of Philetus W. Gates) was the pioneer manufacturer of Chicago and the region west of the Alleghenies, having established his business in 1842. From 1861 to 1871 the Eagle Works Manufacturing Co., of which he was president, employed about one thousand men, and in those days was a noteworthy industry. In 1871 the Eagle Works Manufacturing Co , went out of existence and from it were organized Gates Iron Works and Fraser & Chalmers, each taking a portion of the business. Both of these companies in turn were taken over by Allis-Chalmers Company in 1901.

Messrs. Hoyt and Gates after a well earned vacation spent in travelling, will re-engage in business in Chicago.

The Dominion Iron and Steel Company have ordered from a Pittsburgh firm, a coal washing plant of a capacity of 100 tons per hour ; with an agreement to duplicate the plant, (thus giving a total capacity of 200 tons per hour), if conditions are satisfactory. The date for the completion of the first unit is May 15, 1904.

The new General Manager, Mr. Graham Fraser, is busily engaged in effecting economies of production, and in determining what are the profitable lines of business of the Company.

It is reported that many of the finer lines of iron and steel manufacture which have been contemplated will not be taken up at present, but that the rolling mill will be kept at work on rails of standard sizes and dimensions.

The Executive Committee of the Dominion Coal Company held a meeting at Montreal on the 2nd instant, at which the Annual Report was submitted and discussed.

The output for 1903 (3,079,563 tons) fell slightly below that for 1902, by about 80,000 tons, owing to the fire at Dominion No. 1 Mine. The net earnings for 1903 were $1,756,023.68, or $398,932.31 less than in 1902 The fire above mentioned, with the increased cost at the other pits due to the enforced high pressure of working to fill existing contracts, is reponsible for the decreased net earnings.

The dividend since the divorce from the Steel Company, has been at the rate of 6 p. c. per annum.

The demand for coal has considerably decreased during the last six months owing to depressed trade conditions at home and abroad, and the price per ton realized has also been diminished. The present business of the Company, however, is highly satisfactory and shareholders can keep easy minds.

The Nova Scotia Steel & Coal Co., Ltd., held a meeting of its directors in Montreal on Saturday, the 12th inst. The report of the General Manager showed the Company's business during the past year, to have been the largest and most profitable in its history. The profits for 1903 were $859,-397.19, against $609,935.25 for 1902. The output from the coal mines was very much increased and the iron and steel plant was fully occupied throughout the the year.

The regular quarterly dividend of 2 p. c. was declared on the preferred stock, and a semi-annual dividend of 3 p. c. on the common stock was also declared, both payable April 15th.

Imports of mining machinery into Canada during 1903 were very large, the total value thereof being $1,281,185. Most of the machinery imported was supplied by manufacturers in the United States, the value of the imports from this source being $1,206,465, while from Great Britain machinery to the value of $61,425 was imported. Great Britain, however, supplied us last year with nearly double the quantity of wire rope to that furnished by the United States.

Imports of mining machinery, 1903		$1,281,185
" " " 1902		851,339
Increase for 1903		$429,846
Imports from United States	$1,206,465	
" " Great Britain	61,425	
" " all other countries	13,295	
Total	$1,281,185	
Imports of Wire Rope from Great Britain		$119,135
" " from United States		60,676
" " from other countries		6,153
Total		$185,914

The following comparative table of coal shipments in 1902 and 1903 will illustrate the active conditions which prevailed in the coal industry in Nova Scotia during the year just passed :—

Name	1902 Tons	1903 Tons
Dominion Coal Co	2,939,991	2,802,134
N.S.S. & C.C., including M. M	268,704	451,993
Cum. Ry. and C. C	435,791	435,716
Acadia Coal Co	278,838	337,213
Intercolonial Coal Co	200,581	232,056
Inverness Coal Co	67,399	165,738
Port Hood Coal Co	39,007	77,940
Gowrie & B.H	18,700	23,330
Maritime Mining Co	1.700	19,700
Sydney Coal Co	9,290	12,909
Joggins Mine, Approx	50,000	50,000
Minudie Mine, Approx	15,000	20,000
Cape Breton Coal Co	10,000	10,000
Other Collieries	10,000	12,000
Totals	4,345,000	4,650,000
Increase 1903		305 000

Germany reports the following figures of the consumption of foreign copper for January, 1904 :—

	1904 Tons.	1903 Tons.	1902 Tons.
Imports	9,391	6,829	9,705
Exports	676	795	1,482
Consumption	8,715	6,034	8,223

NEW COMPANIES.

BRTISH COLUMBIA.

New Imperial Mines, Limited.—Incorporated 20th February, 1904. Authorized capital, $100,000 divided into two thousand shares of $50.00 each. Formed to carry on the operations of a Mining Company in the Province of British Columbia, or elsewhere in the Dominion of Canada.

Yale Hydraulic Mining Co.—Registered as an Extra-Provincial Company 22nd February, 1904. Authorized capital, $50,000 divided into one million two hundred and fifty thousand shares of four cents each. Head Office : Whatcom, Washington, U. S. A. Canadian Office : Robie Lewis Reid, New Westminster, B.C., Attorney.

Pacific Mineral Extraction Co., Limited.—Incorporated 29th January, 1904. Authorized capital, $100,000 divided into one hundred thousand shares of $1.00 each. Formed to acquire and take over as a going concern the business now carried on at the City of Vancouver, B.C., of the " Universal Gold, Silver, and Platinum Extraction Syndicate."

Richard III Mining Co., Limited:—Incorporated 15th February, 1904. Authorized capital, $650,000 divided into six hundred and fifty thousand shares of $1.00 each. Formed to carry on the operations of a mining company in all its branches.

Spy Glass Mining and Development Co., Ltd.—Incorporated 11th February, 1904. Authorized capital, $500,000 divided into five hundred thousand shares of $1.00 each. Formed to carry on the operations of a mining company in all its branches.

Queen-Dominion Mining Co., Limited,—Incorporated 17th February, 1904. Authorized capital, $500,000 divided into five hundred thousand shares of $1.00 each. Formed to carry on the operations of a mining company in all its branches.

Golden Copper Mining Co., Limited.—Incorporated 29th February, 1904. Authorized capital, $200,000 divided into two million shares of ten cents each. Formed to carry on the operations of a mining company in all its branches.

" The Bentley Iron Mining Company, Limited," Non-Personal Liability.—Incorporated under the Statutes of British Columbia, 9th March, 1904 Authorized capital, $30,000 in thirty thousand shares of one dollar each. Formed to acquire the properties known as " The Bentley Iron Mining Company, Limited."

" The Cascade Copper Mining Company, Limited, Non-Personal Liability." Incorporated under the Statutes of British Columbia, 10th March, 1904. Authorized capital, $250,000 in one million shares of twenty-five cents each. Formed to acquire the properties known as " The Bentley Iron Mining Company, Limited "

Reliance Gold Mining Company, Limited," Non-Personal Liability."—Incorporated under the Statutes of British Columbia, 5th March, 1904. Authorized capital, 600,000 in six hundred thousand shares of one dollar each Formed to acquire the properties known as the " Reliance Gold Mining and Milling Company, Limited."

ONTARIO.

The Aberdeen Development Company, Limited.—Incorporated under the Statutes of Ontario, 12th February, 1904. Authorized capital, $300,000 in three hundred thousand shares of one dollar each. Directors : H. Wile, M. Wile, M. Peccard, S. Schlesinger. Head Office : Township of Aberdeen, District of Algoma. Formed to acquire the prowerties known as " The Aberdeen Development Company, Limited."

MICA NOTES.

There seems to be a change for the better in the mica market, which was very quiet in 1903, owing to the mica merchants of the larger centres, holding back their larger orders in anticipation of a further fall in prices, especially for the larger sizes. From reliable reports received, it appears that there is a slackness in the supply of East India mica to London, and it is said that the principal buyers will have to look in future for their requirements to Canada. The old phosphate mines, which were operated some 15 to 20 years ago in the Ottawa Valley and in the Lievre District, exhibit all more or less the occurence of mica in connection with the Apatite deposits, in some instances to such an extent that the quality of the phosphate was seriously impaired. There appears to be no doubt that, if operations in many of these mines were resumed and if the demand for mica increases, this industry will assume larger proportions and the Lievre and Ottawa Districts will once more come to the fore as prominent producers.

The Blackburn Mine in the XI Range of the Township of Templeton has a record for over 30 years as a phosphate and mica producer. Up to 1893 this mine was worked for phosphate alone, but it had to cease operations owing to the depressed condition of the phosphate market ; during these operations large deposits of mica were met with, but, were then thrown, as useless, into the waste dump. Since the year 1893, when the demand for mica commenced, the mine has been worked exclusively for this mineral, and large quantities have been extracted The mine has attained a depth of about 300 feet, a force of 70 to 80 men being steadily employed ; it is equipped with a large steam and electric plant and has all accessories for the preparation of the mica for the market.

The Wallingford Mica Co. is working its properties (lots 16 and 17 in the 8th Range of Templeton and the Battle Lake Mines, which comprise lot 6 and 7 in the 13th Range and lot 9 in the Gore of Templeton). On lot 16 in the 8th, a shaft has been sunk to a depth of 225 ft., on a solid vein of mica striking in an east and west direction, with a width from 8 to 13 feet. This mine has been worked without interruption since 1892. The vein which shows well defined walls. has yielded a very large amount of marketable mica of good quality, and there seems to be a supply of mica for years to come. The other properties belonging to the Wallingford Mica Co., (the Battle Lake Mines) were worked for phosphate in the early eighties. Recently these properties were thoroughly explored for mica, and discoveries have been so encouraging that operations on a large scale have been commenced. This mine is also equipped with a good plant and accessories for deep shaft mining.

The Wakefield Mica Co. owns a mica mine on lot 16 in Range 2 of Wakefield. A shaft to a depth 175 feet has opened up a solid vein of mica and calcite with a width of from 5 to 8 feet. This mine has been in operation for about 9 years and has yielded a very large quantity of mica of excellent quality. Owing to a disagreement amongst the shareholders, the Company at present is in liquidation.

Canada Industrial Company., Limited. There is a current report that this Company, (which has its head office in Montreal) will resume operations on their extensive properties in the Templeton District. Most of these properties were worked for phosphate some 12 years ago, and in the course of working mica was met with in nearly all the pits.

Big Fall in Anthracite Output.

The January output of anthracite coal, according to the official figures, amounted to 3,726,786 tons, a decrease of 2,238,164 tons as compared with January, 1903, when 5,964,950 tons formed the greatest monthy production of anthracite on record. The large decrease in tonnage has been the result entirely of changed conditions. At the former time the country was just recovering from a six months' strike and every ton of anthracite mined was in demand, while during the past month conditions were on a normal basis.—*Exchange.*

MINING NOTES.

A report has been received that the mill of the Mountain Lion Mine at Republic, Washington, U.S.A., has made a run in low grade ore with a very successful saving of values, the percentage of recovery being 83. The ore was ground so fine that 89 p. c. passed an 80 mesh sieve ; the value of the ore treated is not stated.

The Canada Corundum Company, Limited, announces the completion of its new mill, and that it is now ready to supply the wants of all customers.

The Paradise Mine in East Kootenay is steadily shipping ore ; many hundred sacks of ore are already stored in the warehouse at Wilmer Landing on the Columbia River, and will be shipped thence early in the season.

The North Star Mine is making steady shipments to the Hall Mines smelter at Nelson. The rate of output is about 100 tons per week, besides which the work of development is being continued.

It is announced that mining and concentration work at the Ruth Mine, in the Slocan, has been suspended. Both the mine and concentrator have been steadily at work since June 1903, and the suspension will prove to be only temporary.

The Four Mile District announces a new streak of high grade ore on the Lew Dillon group, near the Fisher Maiden.

The Athelstan Mine, in Wellington camp, has been making regular ore shipments during the winter, some twenty teams are employed in the hauling of ore from the mines to the spur track at the Winnipeg Mine, from which shipments are made to the smelters at Granby and Greenwood.

A regular pay-day has been proclaimed at the Great Northern Mines, Limited, near Camborne, and the 15th of each month is the day which has been appointed. The amount of the monthly disbursements aggregate in in the vicinity of $4,000. The Oyster mines disburse a similar amount monthly.

The Rossland Power Compauy has been employing about sixty men in the work of constructing a 200 ton concentrating plaut, which it is hoped will be ruuning in about three month's time. This Company will handle the low grade ores coming from the War Eagle and Centre Star Mines, and its success will occasion the employment of a considerably larger force of miners.

The White Bear Mines announce that it will begin the construction of a 100 tou concentrating plant in about a month's time

Press despatches advise that the Velvet—Portland Mine near Rossland, will resume operations shortly, and that the corporation will begin the construction of a 100 ton smelting plant.

Rossland reports that 900 men are employed in the mines of that camp at the present time, and that the number does not vary much from week to week.

The Granby Consolidated Mining Smelting & Power Company report that it is smelting in the neighbourhood of 2 000 tons per day at the present time, and that the furnaces are kept in continuous operation. On the authority of an interview with Mr. Flumerfelt, it is stated that the management have in contemplation the doubling of the present capacity, increasing the total number of furnaces to twelve, thereby enabling the plant to reduce 4,000 tons per diem. This report lacks the confirmation of the President.

The B. C. Copper Company have issued a circular which announces that the plan of consolidating with the Snowshoe Co., which has been under consideration, has been abandoned. The plan failed because each Company made stipulations which the other could not meet.

The International Coal & Coke Company, operating in the Eastern Crow's Nest Pass field, have been doing business since the first of the year. The Company controls the town site known as Coleman, which is growing rapidly. A battery of 100 coke ovens is now building, and railwav spurs are being run to the different mines opened, soue 200 men are employed, and the output at the present time is in the neighbourhood of 3,000 tons of coal monthly.

Some optimistic spirits have the belief that the shallow placers of Lardeau Creek, near Trout Lake, will pay for working and have secured a five years lease of one-half a mile on the creek and have also obtained water rights on Half-Way Creek. Their scheme involves the bnilding of a flume which will take the tailings from hydraulicing directly into Trout Lake. The reported tests of the gravel are high, but these tests remain unconfirmed.

The International Nickel Company suffered a severe loss on the 19th of February, in the burning of the concentrating works at Copper Cliff. The loss is estimated at about $175,000, on which there was an insurance of about $90,000. The works had only been erected some three and a half years, and were built by the Orford Refining Co , for the pnrpose of concentrating the matte from the Canadian Copper Co. The final refining was done at the Orford Company's refinery at Constable Hook, N. J.

Our readers will remember the death of Mr. Hosking, a miner at the Le Roi No. 2 Mine, who was drowned in September, 1902, while working at the bottom of the main shaft which was suddenly flooded by a party of miners, in a drift above, suddenly holeing through into the bottom of an old shaft which was filled with water. The widow and her two sons sued the Le Roi No. 2 Company, and they recently obtained a verdict from the jury of $3,223.50 and costs against the Le Roi No. 2 Company.

At the time of the explosion at the Coal Creek Mine of the Crow's Nest Pass Coal Company, in 1902 a number of miners were killed. Damage suits, aggregating something like one hundred in number, were brought against the C. N. P. Coal Company. On the 12th of February, a decision was obtained in the Courts of Ontario on the first seventeen cases, which suits were brought by the Italian Consul at Toronto for the estates of the deceased miners ; these suits were all dismissed. The remaining suits will be tried at the Assize Courts in British Columbia next May, and, by order of the Court, only four of the whole number of cases will be tried ; from the decision on these four a verdict will be rendered in all the remaining suits.

The value of the gold recovered from the districts of Atlin Cassiar and Omenica in British Columbia during the season of 1903, totals between $400,000 and $430,000 as made up from the returns obtained from the Banks and Express Companies ; to this amount may be added about $50 000 which fairly represents small parcels of metal taken out by individual miners of which no record is available. The production from the Omenica District was insignificant, not reaching to the value of $10,000.

The year 1903 in New Zealand shows an increase in the gold production of that colony of 25,269 ozs. of gold, and 186,477 ozs. of silver. The total gold produced for the year was 479,798 ozs., of the value of $9,917,414.

The Russian Department of Mines reports the production of platinum for the year 1903 at 204,892 troy ozs., a reduction of 29,986 ozs. from the product of the year 1902.

The second ordinary general meeting of the Canadian Ore Concentration Limited, was held on the 22nd February, at the offices of the Company at Salisbury House, London Wall, London. Mr. Ernest E. Sawyer presided, and stated in regard to the experimental plant of two units, erected for the Le Roi No. 2 at Rossland, that $2.00 per ton should be the very outside cost of working. The consumption of oil per ton of ore treated had been 1.03 gallons, and there was a concentration of 16 tons of ore into one ; the assay of the final tailings was 75 cents per ton in gold, 15 cents per ton in silver, and one-tenth of one per cent of copper, which losses were regarded by the corporation as being satisfactory. Mr. Stanley Elmore, one of the inventors, gave the meeting the actual figures above quoted, and stated that orders had been secured for a plant at the White Bear Mine at Rossland, and the Massey Mine in Ontario, and that negotiations for plants were pending with other mining companies in Canada.

The London *Critic* is not taking an optimistic view of the condition of Le Roi No. 2 Mine, as shown by the Company's report for the past year. It appears that the Company for that period reported the magnificent sum of £6,208 sterling as earnings, which only permits declaring the small dividend of one shilling per share, or one per cent. on the capital stock ; a balance is carried forward of £9,741. The *Critic* is of the opinion that this balance cannot be maintained, and that there will be more reports of a pessimistic nature. Quoting from the report of the new manager, Mr. Alex. Hill, he says (as to the Josie Mine) : "It would appear to be beyond doubt that the lower levels of this mine are of no value, nor do I believe that any enrichment is likely to occur with greater depth. I expect to be able to extract ore of good quality for the next year, or one and a-half years, but if no further discoveries are made, then all the good ore will be exhausted and the life of the mine may then be considered ended." Similar pessimistic remarks are made in regard to the No 1 Mine, so that prospects are anything but bright, and the shareholders can only wait to see if anything turns up.

South Carolina's Phosphate Industry.

A POSSIBLE CHANCE FOR THE REVIVAL OF THE INDUSTRY IN CANADA.

The following clipping from an exchange shows that some of the sources of Southern phosphates are rapidly approaching exhaustion. It would therefore be well worth the while for owners of phosphate lands in Canada to examine the present market conditions.

The operations in the mining of South Carolina phosphate for 1903 and the amount of royalty received, show a steady decrease, and where ten years ago the State treasury received nearly $300,000 in royalty. this year the amount is little over $15,000. This amount is $12,157.68, less than that received the previous year, the total being but little more than half what it was in 1902. There are five companies in the field, the decrease in the number of tons mined being in the neighborhood of one-half, and if the same proportionate decrease continues as it has done in previous years there will soon be no revenue whatever from the industry. The following is a comparison for 1902 and 1903 :

	Tons
December 1, 1902, to November 30, 1903	45,003
During 1902	86,284
Decrease	41,281
Estimated on hand November 30, 1903	16,810
During	37,314
Decrease	20,504
Amount shipped during 1903	60,536
During 1902	108,416
Decrease	47,880

The royalty in 1903, for shipments, amounted to $15,133.97, against $27,291.65 in 1902.

The amount mined by the several companies is as follows : Coosaw, 369 tons ; Central Phosphate Co., 33,706 ; Beaufort Phosphate Co., 3,200 ; "Empire," Virginia-Carolina Co., 73 ; Stono mines, 7,655.

Important to Shippers of Mining Machinery and Supplies to the Yukon.

Regulations of 30th April, 1898, *re* Entry of Goods into the Yukon District via Skagway, Alaska.

"Goods purchased in Canada, duty paid or free, and goods the produce of Canada, which are carried through Alaska free of United States Customs duties, may be admitted into the Northwest Territories of Canada free of Canadian Customs duties when transported by water from ports in Canada, under Regulations prescribed by the Minister of Customs: Provided, that the identity of the goods shall be established to the satisfaction of the Collector of Customs at the Port of Entry."

The following regulations and conditions are prescribed for the transportation of the goods aforementioned when carried by water from ports in Canada:—

(*a*) A manifest or invoice containing a description of the goods and their value, with the numbers and marks of the packages, shall be presented to the Customs Officer at the Canadian frontier port in the Yukon District or Stickeen.

(*b*) The certificate of a Canadian Customs Officer is required to be endorsed on the manifest or invoice to the effect that the goods described therein have been "shipped duty free from a Port in Canada."

(*c*) The certificate above mentioned may be granted when the shipment by water from a Canadian port is made by any vessel authorized to engage in such transportation.

The Dominion Coal Co's New Mine.

The new mine which the Dominion Coal Co. is planning to sink will rival the present Dominion No. 2 Colliery, which is the largest on the Continent, and on which work was begun three years ago. James Ross, F. L. Wanklin and J. Reid Wilson have been at Sydney, N. S., several days examining the situation and surveys of the various proposed sites, and it is stated on high authority that Big Glace Bay, four miles from Glace Bay, will be chosen. Port Morien and Low Point are also mentioned.

Should Big Glace Bay be selected a railway will be built from the colliery to Caledonia, where shipments will be made to either Sydney or Louisburg. A big bridge will be erected over the Big Glace Bay lake in connection with the new railway line. It is understood that when the new colliery is in operation, the International mine at Bridgeport will be abandoned. The Phalen seam will be worked at the new colliery, together with a large submarine area. The opening of the proposed colliery will eventually mean the base of employment for 3,000 men.

Report of the Electricity in Mines Committee.

The Electricity in Mines Committee has now issued its report, and have appended a formidable list of model rules. The tenor of the report appears to be, that electricity is destined to play a very large part in mining of the future, and that any legislative measures that may be passed should be such as would tend to render it safe rather than to prohibit its use.

The use of electricity is likened to the use of explosives in mines which are of great potential danger, but which, with proper precautions may be employed to distinct advantage with comparative immunity. It is also pointed out that the application of electricity to mining work is still in its initial stages, and that greater safety will come with experience. There can be little doubt that the accidents which have been caused by the use of electricity in mines have been due in a great measure to ignorance, in some cases the ignorance of the engineers who were responsible for the installation, and in others the ignorance of the individual workman. These are evils which time will practically eliminate.—*Mining Engineering*, March 1904.

Self-Hardening Steels.

One of the recent notable developments in the metallurgy of steel has been the manufacture of what is known as self-hardening or high-speed steels, which are adapted for tools working at a high rate of efficiency. There is a great variety of these steels on the market, and they show wide differences in composition, although usually containing some of the rarer metals, such as tungsten, molybdenum and chromium. Tools made from these steels can work without injury at a temperature of 500° or 600° C.

Coal Compression Before Coking.

It has not been thoroughly ascertained as yet by scientific investigation why the coking properties of coal are influenced by stamping or compressing, and while it is only imperfectly understood how the process is affected by external or mechanical influences, it is a fact that compressing of coal improves its coking qualities. An explanation of this could perhaps be that, in using coal of a low percentage of volatile matter, the voids between the particles of coal are too large for the small available quantity of products of distillation necessary to exert a binding influence. It may, therefore, be assumed that by compressing the coal and reducing the spaces, bringing the particles of coal closer together, a firmer binding is effected.

Whatever the theoretical explanation may be, the practical advantage of compressing the coal before coking is that the coking capacity is increased, which enables a poor coking coal to be converted into a more or less reliable coke. The output of available coke is also increased by several per cent., as the percentage of small coke and dust is reduced to a minimum.

By stamping, the coal is reduced about 30 per cent. of original bulk. On account of the small clearances allowed between the cake of coal and the oven walls, the coal cakes less to the walls, and the pushing out of the coke is greatly facilitated, whereby the wear and tear of the walls is very materially lessened. In consequence, in building new ovens the oven walls can be made quite parallel, which is of great importance in the even heating up, and also reduces the cost of construction. The coking time proves to be about the same whether the oven is working on stamped or unstamped coal. The coke made from the machine-stamped coal is particularly suitable for the production of pig iron, as by the use of such coke the quantity necessary for the blast-furnace process is from 10 to 15 per cent. less in bulk than when using coke from unstamped coal.

All these advantages constitute the main reason why such keen interest has of late been manifested in the question of coal stamping; advantages which not only enable coal of poor quality to be utilized for coking purposes, but also are conducive to the saving of time and labor in the case of such coal thoroughly suitable for coking.—*Mines and Minerals.*

MISCELLANEOUS.

Canadians understand the value of good roads in the mining regions. As soon as gold was discovered in the region of the Klondike the Dominion Government immediately began the construction of roads leading from Dawson to the camps. It now has 225 miles of thoroughly built roadways, over which the heaviest freighting is done.

The miner's inch in California previous to 1903 was an unfixed term varying in different localities to a discharge from 1⅓ to 1¾ cubic feet per minute. In that year the law was amended and a legal miner's inch now consists of that quantity of water which will flow through an opening of one square inch under a pressure of four inches above the opening. Each square inch of this opening represents a miner's inch and is equal to the flow of 1½ cubic feet of water (approximately 9 gallons) per minute.

The United States Geological Survey reports that a tin-bearing ledge has been located 15 miles east of a little settlement called York, situated in the western extremity of Seward Peninsula. The ledge occurs in a granite dike between limestone walls. The cassiterite, or tin oxide, is found disseminated through the rock in small particles. A group of claims has been located and steps have been taken to develop the property. York is at the mouth of Auikovik River on the northwestern coast of Alaska. It is 35 miles west of Teller and 90 miles from Nome.

Local men are developing the newly-discovered silver and cobalt deposits, near Haileybury, on the line of the Temiskaming Railway, the ore of which is piled up ready for shipment when spring opens.

A fire on February 19 damaged the smelting works of the Canadian Copper Co., at Copper Cliff, Ont., to the extent of $150,000, and the staff of 1,100 men were temporarily thrown out of employment. The directors at Toronto, on February 22, made arrangements by which the company could secure the use of the Mond smelter at Victoria Mines until the works were rebuilt. The new works will be rebuilt on an enlarged scale

An order-in-council has just been passed by the Dominion government rescinding the regulations for the disposal of hydraulic mining locations in Yukon territory, which were adopted in December, 1898, and frequently amended. Mining will henceforth be carried on under placer regulations. Leases granted under the regulations are not interfered with.

The town of Collingwood, Ont., is applying to the Ontario legislature for an act modifying its former agreement with the Cramp Steel Co. On consideration of a $115,000 bonus the company undertook to erect smelting works and steel furnace, to be in operation July 1 next. The steel plant is ready, at a cost of $400,000, but the company seeks to be relieved of putting up a smelter now, as it does not wish to be restricted as to time. The town is willing to relieve it of the obligation on condition of the bonus being reduced to $60,000.

At the annual meeting of the National Portland Cement Co., Ltd., operating near Durham, in Grey county, Ont., the financial report showed a net losst of $10,087 on the year's business. The liabilities are $1,161,561 and the assets $86,936 less. The total receipts were $271,597.

Iron and Steel in Mexico.—In a report on Mexico recently issued by the Foreign Office, it is stated that though the working of iron in the Republic has not yet received the impulse that has been given to gold and silver mining, attention is now more generally called to the existence of iron in many of the States, especially in Durango, in which is situated the famous "Cerro del Mercado," said to be almost of solid iron. Iron foundries are being erected in several of the large towns, and Monterey has set the example by the erection of a large steel plant, with a working capital of $10,000,000, for making steel rails, girders, bar iron, machinery, tool steel, pig-iron, etc., which was formally opened and the first steel was cast in June, 1903. The total value of the imports into Mexico of iron and steel, and the manufactures thereof, in 1902, amounted to $9,033,965, as against $7,667,965 in 1901.

GEOLOGIST FOR NEW ZEALAND.

THE New Zealaud Government invite applications for the appointment of a Geologist, Salary £600, Passage provided. Selected Candidate must arrive in Colony by first August next. Applications, stating age, qualifications and number in family, to be sent to the Hon. The Minister of Mines, Wellington, New Zealand.

SALE OF VALUABLE MICA MINE
IN CANADA

PURSUANT to the Order of the High Court of Justice, for the winding up of the Wakefield Mica Company, there will be offered for sale by public auction at the Local Master's Office, in the Court House, in the City of Ottawa, in the Dominion of Canada, on the

17th DAY OF MAY, 1904, at 2.30 P.M.

1. All the mines, minerals and mining rights in and upon Lot No. 16 in the 2nd Range of the Township of Wakefield in the County of Wright in the Province of Quebec, containing 200 acres, with the buildings erected thereon for mining purposes.

2. Water power and mill privilege on Blackburn's Creek on said Lot, containing one acre in fee simple, with saw-mill thereon erected, and electric dynamo and other machinery therein, including auxiliary steam plant.

3. All wood and timber on Lot No. 16 B in the 3rd Range of said Township, with free right to cut and remove same up to the 29th day of October, 1916.

4. A large quantity of mining plant and machinery, consisting of electric pump, motors, belting, shafting, derricks, drills, blacksmith's tools, rope, piping, telephones, stoves, cutlery &c.

The property is situate about six miles from Wakefield Station on the O.N. & W.Ry., and about 20 miles from the City of Hull. A shaft has been sunk to a depth of 170 feet and a considerable amount of mica has been extracted therefrom. Specimens of the mica and a detailed inventory of the chattels, a report of an independent Mining Engineer, and other information may be obtained from the Liquidator.

The entire property will be sold in one block, subject to a reserved bid fixed by the Master.

Ten per cent of the purchase money must be paid at the time of sale, and the balance within 30 days.

Dated the 21st day of January 1904.

ERNEST A. LARMONTH,
Liquidator,
48 Elgin Street, Ottawa, Canada.

W. L. SCOTT,
Local Master at Ottawa.

JUDICIAL SALE

OF

GOLD MINING PROPERTY IN THE DISTRICT OF RAINY RIVER.

IN THE HIGH COURT OF JUSTICE

In the matter of The Winding Up Act, being Chapter 129 of The Revised Statutes of Canada and Amending Acts, and in the matter of The Decca-Chemical Consolidated Mining Company of Ontario, Limited.

TENDERS will be received by William Louis Scott, Esquire, Local Master of this Court at Ottawa, at his office in the Court House in the City of Ottawa, up till Twelve o'clock noon on

FRIDAY, the 13th day of MAY next, 1904,

for the following Gold mining properties owned and operated by the said The Decca-Chemical Consolidated Mining Company of Ontario, Limited, and situated in the District of Rainy River, and Province of Ontario, being:

1.—That Leasehold of Mining Location K 264 east of Bad Vermillion Lake, registered in the Land Titles Office at Rat Portage as parcel 191 in the Register for Leaseholds.

2.—That Leasehold of Mining Location 712 P situate on Bad Vermillion Lake, Seine River, registered in the said office as parce 577 in the Register for Leaseholds.

3.—That Freehold property, Mining Locations S 294 containing 50 acres situate north of the east end of Witch Bay on the east side of Lake of the Woods and J. O. 113 containing 23 acres situate west of and adjoining S 294 above described, registered in the said office as Freehold parcel 2159, north division.

4.—That Freehold property, Mining Location J. O. 133 situate north-east of Witch Bay of the Lake of the Woods, registered in the said office as Freehold parcel 2337, north division.

5.—That Freehold property Mining Location K 222, containing forty acres situate north of Shoal Lake, Seine River, in the District of Rainy River, as shown on Plan of Survey made by O.L.S. James McCallum, dated the 28th day of August 1894 of record in the Department of Crown Lands.

TENDERS must be sealed and addressed "W. L. Scott, Esquire, Local Master, Court House, Ottawa," and marked "Re Decca-Chemical Consolidated Mining Company of Ontario, Limited, Tender for Property," and each tender must be accompanied by a certified cheque payable to A. P. Mutchmor, Liquidator The Decca-Chemical Consolidated Mining Company of Ontario, Limited, for not less than ten per cent. of the amount of such tender. Such cheque will be returned in the event of the tender not being accepted. Upon the acceptance of any tender the balance of the purchase money shall be paid to the said A. P. Mutchmor within fifteen days thereafter, and the purchaser shall thereupon be entitled to a transfer of the property. In the event of the Purchaser failing to pay the said balance of the purchase money the deposit of ten per cent. above mentioned shall be forfeited and the property may be re-sold, and any deficiency therein shall be made good by the defaulter.

The purchaser shall prepare the transfer of the property at his own expense and will tender the same for execution and all expenses incidental to the investigation of Title and the registration of the Transfer shall be borne by the purchaser.

The property will be sold subject to the rents, taxes, encumbrances or dues of any sort whatsoever owing to the Government or to any person or corporation whatsoever, which are said to amount to about $60.00.

The highest or any tender will not necessarily be accepted.

Further particulars may be had from Messrs Murphy & Fisher, Barristers, Ottawa.

Dated at Ottawa this 25th day of February, A.D. 1904.

MURPHY & FISHER,
19 Elgin St., Ottawa,
Solicitors for Liquidator.

W. L. SCOTT,
Master at Ottawa.

Dominion of Canada

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be aquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7 50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee, $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be obtained within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one half per cent on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200.

A certificate that work has been done must be obtained each year: if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior,
OTTAWA, February, 1904.

JAMES A. SMART,
Deputy of the Minister of the Interior.

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction or 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P. Q.

Ontario's Mining Lands..

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite: copper in sulphide and native form; gold, mostly in free milling quartz; silver, native and sulphides; zincblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1900 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe. The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc., apply to

HONORABLE E. J. DAVIS,
Commissioner of Crown Lands,

or

THOS. W. GIBSON,
Director Bureau of Mines,
Toronto, Ontario.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars. for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

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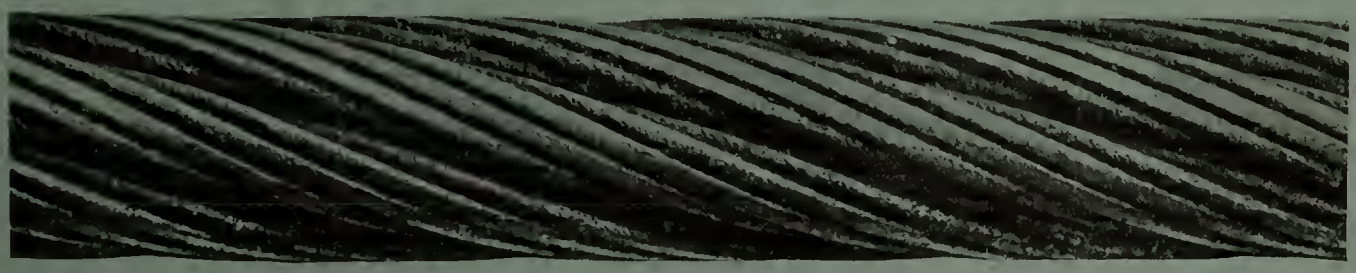

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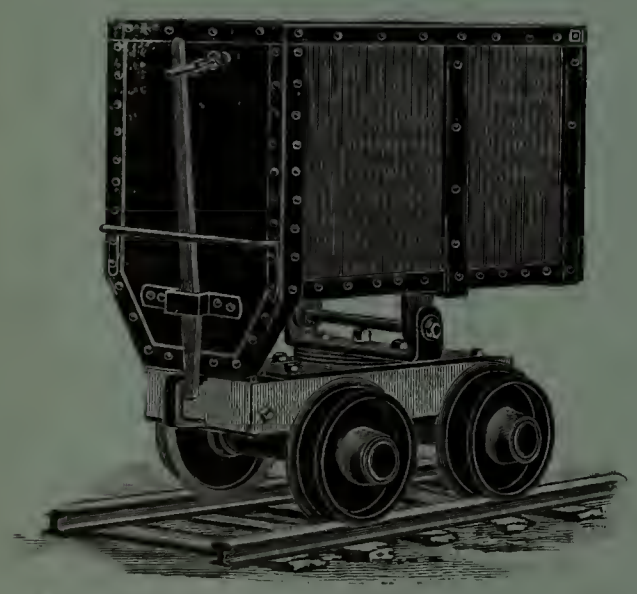

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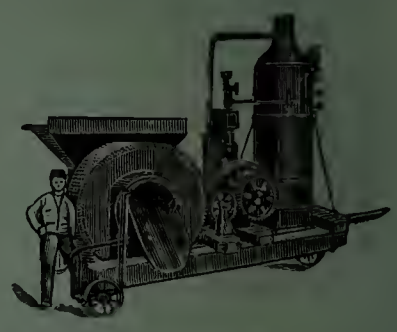

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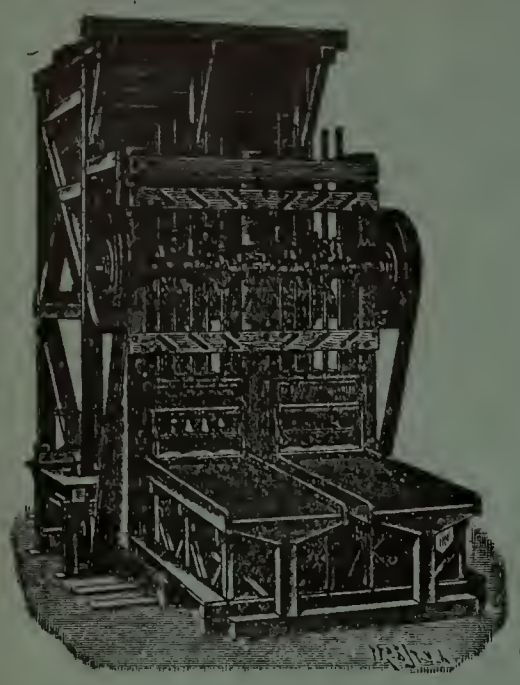

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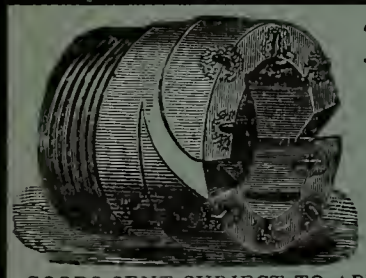

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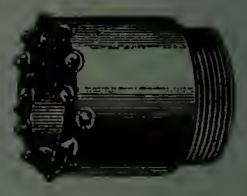

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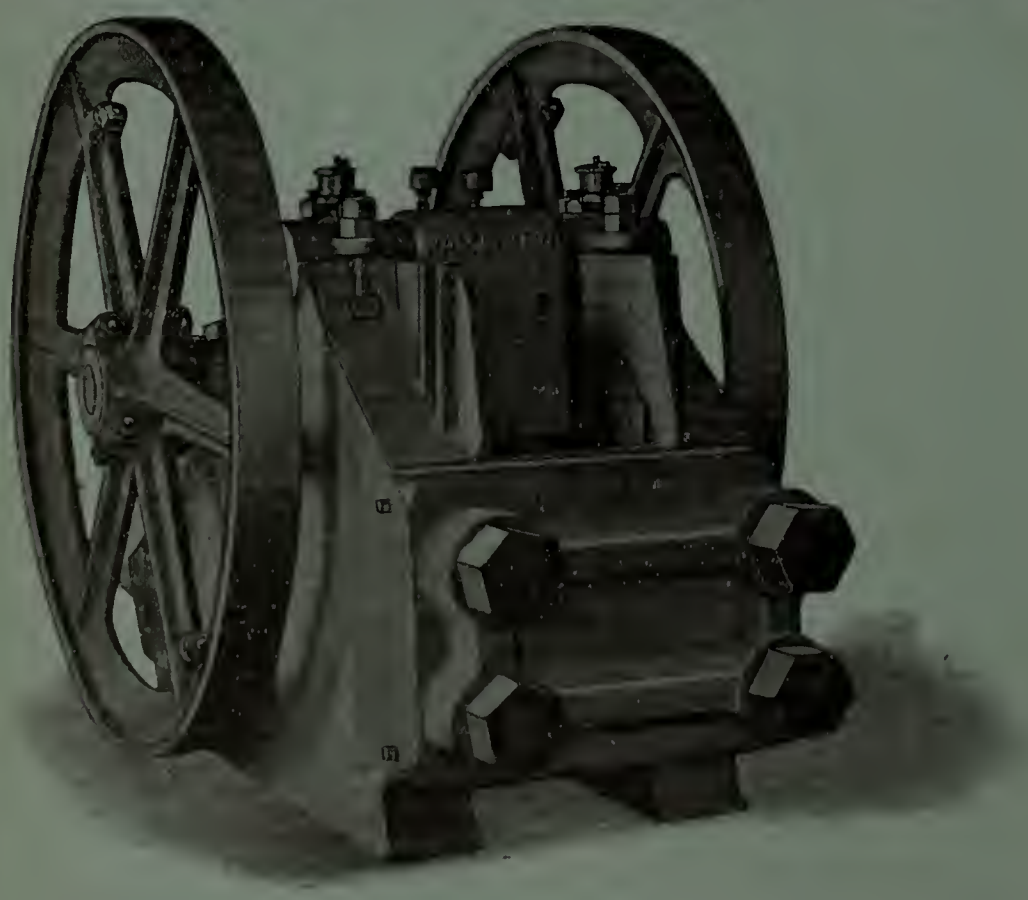

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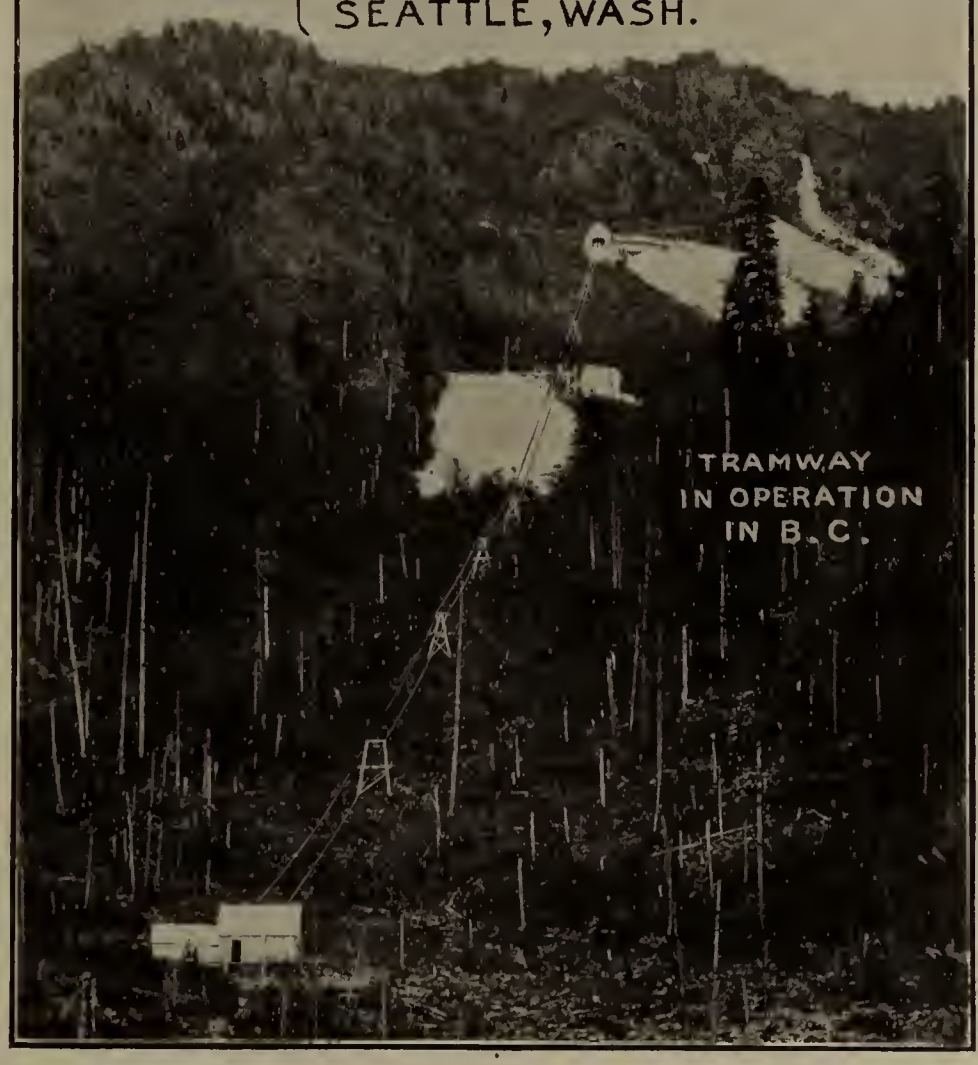

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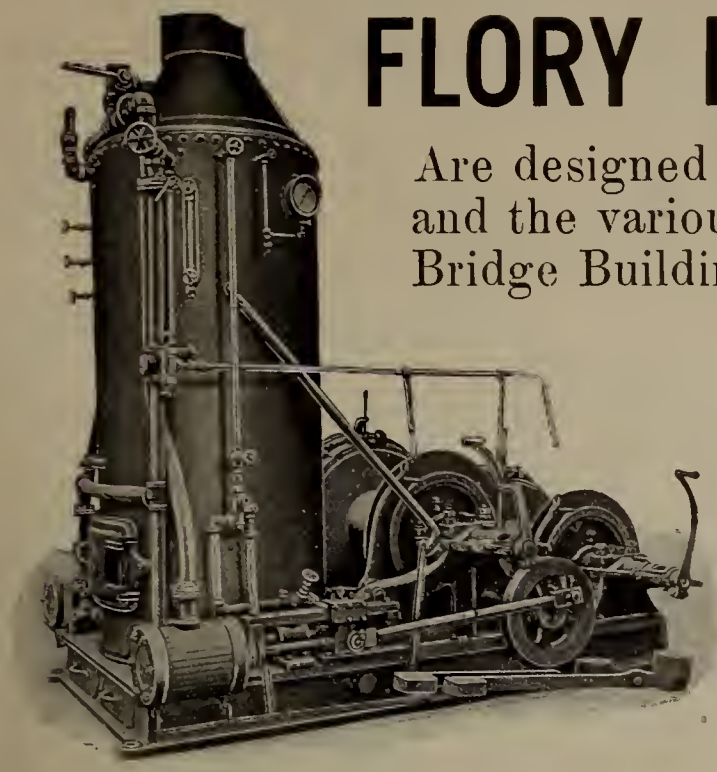

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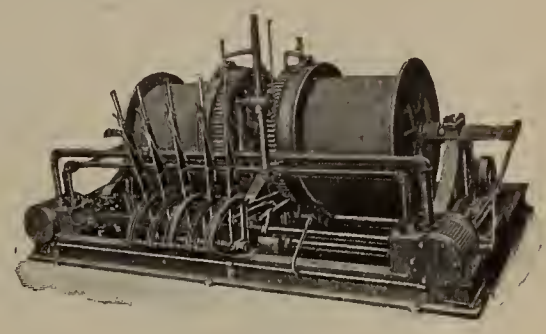

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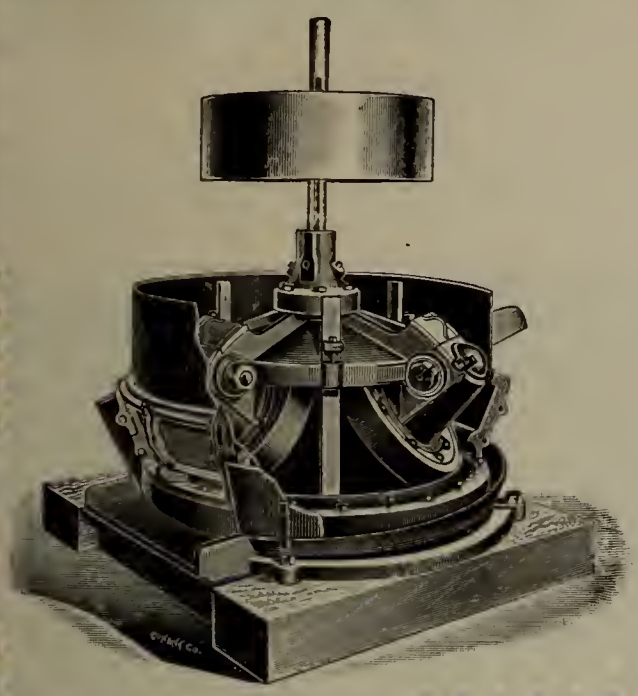

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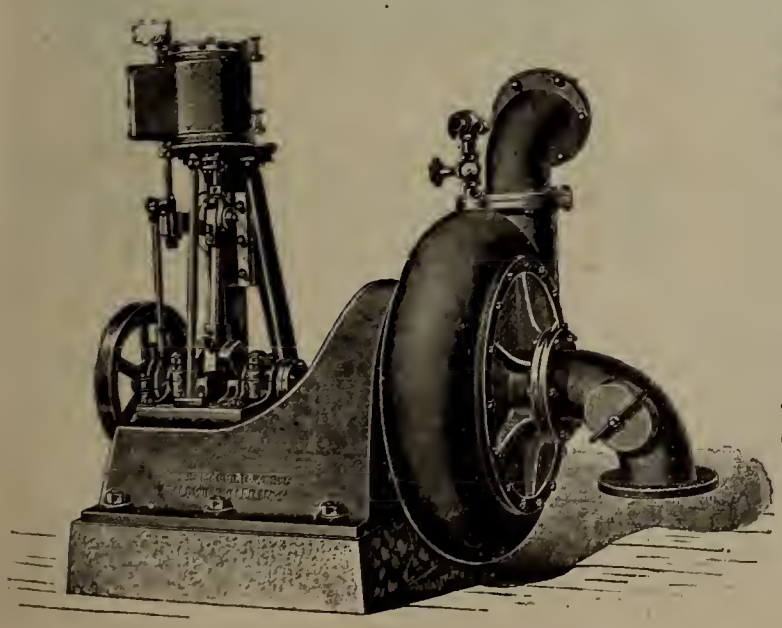

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CONTENTS.

British Columbia and the Lead Bounty.

The bounty on lead which was granted by the Dominion Government has now been payable for some three months, and the first payment was made this month to several producers, as is mentioned in this issue in our "Mining Notes," from British Columbia.

The resumption of mining operations by the silver-lead companies has been eagerly anticipated by shareholders, and the month of April has seen an unusual amount of activity in the Slocan and in East Kootenay. The St. Eugene mine started up about the 20th of April at full capacity, having agreements which ensure a market for over 30,000 tons of its concentrates.

From the reports of the meetings held between the lead mine operators and the smelter representatives, as given in press reports during the last six weeks, it appears that several disagreements arose, amongst others the question of what proportion of the bounty was to be received by the mine and what by the smelter. The end of the month of March witnessed several meetings of the Silver-Lead Mine Owners Association, and of the Boards of Trade of most of the mining towns in the Kootenay District. The Mine Owners Association proposed addressing a Memorial to the Dominion Government praying that the bounty be made payable on a fixed quantity of lead ore to be exported out of the country, and promising that the lead smelters should be given a sufficient quantity to keep their furnaces in full operation.

To such a proposition there was not, naturally, a unanimous consent on the part of the Mine Owners, nor did the proposal fully meet the views of the representatives of the smelters. In consequence a joint conference was arranged to be held between the mine owners and the smelters for the 29th of March. In order to fully appreciate and correctly comprehend the results finally reached by this joint meeting it is advisable to give a few of the facts and proposals which obtained before this important meeting was held.

The granting of the bounty last year was the cause of the re-opening and increased development of many lead mines which had previously closed from lack of market. The smelters had done what was possible by them by reducing charges, and the C.P.R. had also reduced freight rates, so that at the first of March, 1904, the basis was (in brief) a freight and treatment charge of $11 per ton on ores of not less than 20% lead contents, and $15 per ton on ore of 40% lead, or better, with a penalty of 50 cents per unit for zinc in excess of 10%, and an additional charge of 1 cent per pound on lead contents of ore, which was supposed to defray costs of marketing the lead in England, or on the Continent.

Recently, the smelters at Trail and Nelson asked the Mine Owners Association to guarantee an annual production of 40,000 tons of lead ore, or accept an increase of $2 per ton in charges. To get such a production as 40,000 tons per annum meant the compliance of the big St. Eugene Mine, and if that mine remained closed down the other silver-lead ore producers had no recourse but to accept an increase of $2 per ton in freight and treatment charges. The pressure used brought Mr. T. G. Blackstock to British Columbia, accompanied by Mr. Ehrenzoller, the New York representative of European ore buyers. Mr. Ehrenzoller said to the Mine Owners Association that he would take up to 50,000 tons a year, for a period of two years, of silver-lead ore which would average not less than 55% of lead and 40 oz. of silver per ton of ore, and offered a freight and treatment rate of $8 per ton, the ore to go by rail to Vancouver, and thence by water around Cape Horn to Europe.

This offer from a European Agent, brought the local smelters to the point of offering to take the entire output of the mines of both East and West Kootenay Districts, irrespective of quality or grade, for a period of 12 months, but with present charges.

The smelter representatives discussed details with the mine owners which resulted in a concensus of opinion to memorialize the Government to permit (a) the Canadian lead smelters to export such ore as was in surplus of the amount needed for their furnaces, and to receive the bounty, payable under the Bounty Act, on such surplus

exported; (b) the payment, to the producers or miners of such exported ore, of the full bounty of $15.00 per ton if there remained from the $500,000 appropriated, a sufficient sum to pay the full bounty; if not, then to receive such reduced bounty per ton as would absorb the balance remaining from the $500,000, after payment of bounty had been made on the ores smelted by the local smelters.

This Memorial, after modification and acceptance by the Mine Owners and smelters at a meeting held on March 29th, was endorsed by the Board of Trade meeting, held at Nelson on the 30th of March, and in the language of the street, "it was up to the Government."

The western papers have not dealt with the question of what percentage of bounty is going to the smelter and what to the mine owner, but it is known that in some cases the smelters have obtained over 75 per cent. of the bounty payable.

That the mine owners regard the terms as satisfactory may be inferred from the resumption of work at the St. Eugene Mine, where, as before stated, work is now in full blast. This mine expects to produce 36,000 tons of high grade concentrates during the next twelve months, of which 18,000 tons will be exported and approximately 18,000 sent to the local smelters.

That the proposal is equally satisfactory to the smelters is evidenced from the remarks of Messrs. Aldridge and Campbell at the Board of Trade meeting, where both gentlemen approved the agreement.

Any solution of the troublesome lead problem that is satisfactory to the mine owners, should be satisfactory to the country at large, and the REVIEW rejoices that the first lode-mining industry of British Columbia, (that of silver-lead) has again the promise of a vigorous life—we hope it may be a long one.

The Electric Smelting of Iron Ores.

The technical press of Europe and America has, during the last six months, been giving considerable attention to the matter of smelting iron ores, or iron scrap, into pig iron and steel by the use of electricity. It will be remembered that the Canadian Government, at the close of last year, appointed a Commission, under the leadership of the Dominion Superintendent of Mines, to proceed to Europe and inquire into this subject; the Commisson has returned, and an authorative pronouncement on this topic may shortly be expected. In this issue the REVIEW offers to its readers the conclusions of the best authorities who have previously investigated the matter.

The object of the different electric processes which have been invented and tested during the last six years has been to secure the direct reduction of iron ores to metallic iron by means of the electric current, and without the use of fuel to melt the iron and slag products. Most of the methods exploited have aimed to effect this reduction in one operation and one furnace, but some inventors have used two furnaces and thereby have claimed to produce a high grade steel. Both the electric arc and the electric resistance furnaces have been used, the majority, however, using the arc by reason of its being the most efficient method of applying the electric current. But it has developed special difficulties since the arc method permits only comparatively small portions of the mixture to be subjected to the action of the arc at any moment of time, and necessarily increases the cost of the product because of the necessary reduction of the ore to small particles, to permit of its being mixed with the reducing carbon and fluxes. From this difficulty has arisen the resistance furnace so-called, which has been designed to receive the ore, flux and carbon in the lump form, after the manner of a blast furnace.

The claims made by the inventors of electric smelting methods have been attractive to the iron master and to the capitalist, but have not been of a character to appeal to the owners of coal mines or coke ovens. The amount of electric current needed has been so large that the generation of such current, by the burning of coal, would be much too expensive to permit of the application of the process. The possession of large water powers, which are permanent, is unfortunately restricted to a comparatively small number of localities. The first matter for consideration and investigation evidently is the amount of electric power needed, and its cost.

At the Stassano (Italy) works, which are now idle, the consumption of power has been given at from 3800 to 4000 horse-power-hours for each ton of metal produced.

At Gysinge, (Sweden) where a crucible process was used, the consumption of power was put at 1,320 horse-power-hours per ton of metal.

At Kerrouse, (France) the power consumed is stated to be 3,800 horse-power-hours, and Mons. Harmet gives his figure at 3,600 horse-power-hours.

The Ruthenberg furnace, experimentally tried at Lockport, N.Y, by the Cowles Electric Company, does not melt the ores to a fluid mass but has been used for two different and specific purposes,—the one to *reduce* iron oxides to sponge iron, preparatory to melting that sponge in an open-hearth furnace,—the other, to *agglomerate* the fine particles of iron oxide, which have previously been separated from earthy matters, and enriched by magnetic or other methods of concentration.

There is, therefore, from four works, an average of 3,800 horse-power-hours as the power required to produce one ton of metal; this number being according to the statements of the inventors, which are open to question as being, if anything, minimized.

To produce 1 horse-power-hour there are required 635.3 calories, or 2,580 heat units; at an efficiency of 80 p.c. this would be about 508 calories. The average calorific value of American coal is given (Suplee's Mechanical Engineers' Reference Book) at 7,598 calories. Since the highest recorded thermal efficiency is (we believe) but 22⅝ p.c., and since, in actual practice, it is rare to attain 15 p.c., if an efficiency of 20 p.c. is assumed, the result will be more favorable than perhaps it should be to electricity.

On such an assumption, the number of calories given out, would be 1,519 per kilo of coal, and 3 horse-power-hours would about equal the effect of 1 kilo (2.2 lbs.) of coal: this gives a consumption of 2,785 lbs. of coal for the production of one ton of metal.

It is, therefore, evident that unless electricity is called for by other considerations than that of smelting alone, it cannot compete in regions where metallurgical fuel is cheap.

In one of the first electric furnaces to run successfully, (Stassano, 1898) a potential of 80 volts with a current of 1,000 amperes was used. The total charge weighed 154.5 lbs. and was made up of 80 p.c. of ore, 9 p.c. of limestone and 11 p.c. charcoal; the ore contained 60 p.c. metallic iron, and yielded nearly 55 p.c. of iron, which (by composition) was a wrought iron. The time required from beginning of charge until the pouring of the metal was 2 hours. The total amount of energy delivered was 132.24 horse-power-hours, and the thermal efficiency was 61.33 p.c.

The cost of producing a ton of metallic iron, by this method, is given by Mon. Stassano, at $21.60, according to the *Iron and Coal Trades Review*, to which we are indebted for a very long and able presentation of this subject. But, as that admirable paper says, inventors' claims and figures are open, in some cases, to serious doubt if not disproof.

Analyses of the iron produced at the Stassano works by this

method, showed carbon, ranging from .04 p.c. to 9.77 p.c.; and manganese, from .05 p.c. to 9.65 p.c. The greatest length of electric arc used attained 40 inches.

All the processes of Stassano, Keller, Heroult and Harmet are substantially in agreement as to the consumption of power and heat used in the reduction. They produce a metal approximately of the character of an open hearth steel, but requiring modifications and extra expense to make the quality of crucible steel.

The Ruthenberg process at Lockport, N. Y., already spoken of, depends upon the formation of an arc, which, in the tests so far made, has been assisted by the addition of cast iron borings. The reduction of the oxide to metallic iron sponge, appears to have been more successful than the agglomerating process, as it forms a product which can be directly charged into an open hearth furnace.

The Heroult process is now being used on a mixture of scrap iron and pig to produce a tool steel, for which there is a ready sale. An electric arc is used on a charge of 3 tons, and to the first of the year 1904, some 1,500 tons had been produced.

The Kjellin process produces crucible steel, but uses soft wrought iron with some pure charcoal pig, and does not attempt the reduction of the metal from its ores. The cost is stated to be $41.00 per ton.

A new process of Mr. Gustave Gin, uses a resistance furnace, which dispenses with the use of carbon electrodes, the ore and coke being disposed in a long channel of small cross-sectional area. This process has not yet had sufficient trial to demonstrate its capabilities, but it is noteworthy that its special claims are on the line of what has already been achieved, namely, the production of special steel alloys, such as ferro-manganese, ferro-chromium, ferro-tungsten and nickel-steel.

The conclusions which may be drawn from the articles in the English and American press, point out that the conditions under which electric smelting may be done *profitably* are very rare. The *Engineering News* shows that 131 electric horse-power-days (of 24 hours) are required for the production of one ton of iron from a 65 p.c. ore. The Kerrouse works, France, require 161 electric horse-power-days for each metric ton (2204 lbs.) of steel produced. In the *Iron Age* Mr. Rossi has stated that, the average result of an actual test extending over ten weeks, was 200 electric horse power-days per ton of metal.

The *Iron and Coal Trades Review* dwells upon the fact that to few localities is given the possession of a sufficiently large water power to smelt 350 tons of iron per day, and compares the first cost figures of a blast furnace plant with those for an electric plant, putting to the latter a cost approximately five times greater than the former. In connection with this article, there has appeared a letter to the Editor of the *Iron and Coal Trades Review*, in which a Canadian gentleman has courteously differed with some conclusions reached. In this letter the statement is made that water powers of 50,000 horse-power are not rare in Canada, and that some can be developed "at a capital cost of $30 per electric horse-power." The point is perhaps worth mentioning, that the REVIEW knows of no development of electricity by water power, where the capital cost has been so low as $35 per electric horse-power.

The power at Shawinigan Falls, Quebec, has probably been developed more cheaply than any existent power in Canada, yet the electrical equipment alone cost $25 per electric horse-power, without considering any capital cost for dams, penstocks, etc., etc. The Lachine Rapids power cost in excess of $85 of capital per electric horse-power developed. The Niagara companies are all in excess of the figures mentioned. The development of a water power upon the large rivers of Canada is variously estimated by the engineers of existent electrical companies at from $50 to $100 per electric horse-power according to circumstances and conditions; the cost of electrical equipment (Dynamos, switchboards, etc.) is put at from $20 to $25 per electrical horse-power so that a minimum of $70 of capital per electric horse-power developed represents the lowest figure obtained as yet in this country, for large powers.

Canada is blessed with huge natural resources, amongst which are water powers, and the REVIEW sincerely hopes the low figures which have been given may be reached; yet if they are, beyond the question of the cost of the neccessary power, arise two other questions which must be solved before Canada can hope for much from electric smelting, and these are the costs of assembling ores and fluxes, and the cost of getting the metallic products to a *profitable* market.

The report of Dr. Haanel, and his colleagues, on these subjects will be authentic, and should be authorative. We may expect some trustworthy figures as to the consumption of electric energy from the Electrician of the Commission, and some reliable data as to the quality of the ores which have been found specially suitable for the electric process. Until the report of the Commission is issued it would be unwise to accept the various statements contained in the articles referred to as in any sense final.

Electricity in Mines.

The report of the British Committee appointed by the Home Secretary to inquire into the use of electricity in mines was issued early in the year, and will be a valuable document to colliery owners and managers.

The Commission has found that electric currents for use in mines are broadly classified into "continuous" and "alternating," and observes that the tendency in America is to use continuous current especially for haulage by locomotives. For generation and transmission the alternating current is more desirable, but for motors which are frequently started and stopped, it finds that up to the present time a continuous current has been the most satisfactory.

It is the opinion of the Commission that electric apparatus which is properly set up and used presents no such dangerous features as would justify the prohibition of its use; it fully considers the points of broken electric lamps with resulting danger of sparks, of winding from shafts, of electric coal cutters, etc., etc., before forming the conclusions which the report expresses.

The question of what voltage should be employed has been considered by the Commission which deals with the evidence submitted, and has also carefully gone into the matter of what restrictions should be permitted as to the voltage of the current at the point where the electricity is to be applied. The report is followed by a lengthy set of rules which are proposed by the Commission for regulating the use of electricity. These rules are too long for reproduction, but their general effect is rather that of instructing or informing the workmen than of imposing restrictions against the use of the electric current. As a matter of fact perusal of the report conveys the idea that the Commissioners are of the opinion that future legislation on the use of electricity should be along the lines of rendering such use safe, and not with a tendency to restrict the application of the electric fluid.

The general treatment of this subject as made in the report suggests the general principles: that the plant should be of good quality and so placed as to ensure its safety from fire or sudden shocks; that the plant should be under the charge of competent persons whose work should be periodically supervised; that all the apparatus should be inspected at stated times and tested as to its efficiency and safety; that wherever and whenever electrical machinery is used in gaseous mines, all such machinery should be so enclosed as to prevent any gas

being reached by a spark, should a machine become dirty or deteriorated so as to generate sparks.

The Rules proposed by the Commission are, as a whole, elementary, and exceedingly simple of observance to anyone at all familiar with electricity. Rule No. 5 is somewhat extended and governs the conditions under which low, medium, or high, pressure voltage may be employed. The Commission has taken low pressure voltage as not in excess of 250 volts; medium, permits of any voltage between 250 and 650; high voltage means any current between 650 and 3000 volts. In the section dealing with switches, fuses and cut-outs, all open type switches, fuses and cut-outs are prohibited, and in the section dealing with motors is the rule that the motor must be stopped if the presence of fire damp is indicated.

CORRESPONDENCE.

Oil In Canada.

To The Editor.

Sir:—

The reports of Mr. F. H. Oliphant on the production of petroleum and natural gas in the United States in 1902, have just been issued by the United States Geological Survey. These reports constitute every year parts of the annual reports of Mr. David T. Day on the mineral resources of the United States, and are, as usual, highly interesting, even more so this year than usual, as a more detailed account of each field is given, not only of the fields in the United States, but also of the foreign fields.

The following important conclusions have impressed themselves upon me in reading these reports, and they may be of interest to your readers:—

1. The enormous value of these products in the United States amounts now, each year, to more than $100,000,000, in their crude state.

2. The enormous amount of energy, work and money devoted to the finding of the pools, or deposits, of petroleum in the United States, there being an average of over 1,300 wells drilled in every month.

3. The number of new districts which become large producers, the percentage of oil produced by the old fields in comparison with the total product in the United States, was 62% in 1902, 80% in 1901, and 91% in 1900, showing the large productions from new fields.

As Canadians, we can draw very valuable lessons from the above conclusions which are suggested by Mr. Oliphant's reports; viz.—from the first we can understand what little conception we have of the truly enormous value of these wonderful products.

From the second, if we compare the fact that 1,300 oil or gas wells are drilled every *month* in the United States, while in Canada we do not drill *twenty* in the same time, we can easily see why our neighbors get valuable oil and gas fields while we do not. The simple reason of it is that we do not drill in search of these products, notwithstanding our heavy duties on oil protecting the Canadian producers. These producers clamor and agitate for an extraordinary amount of protection (which is more than 100% of the price of crude oil in the United States,) and yet they do not help the oil consumers, nor even themselves, by doing a reasonable amount of drilling and exploring for new fields. That these new fields exist in Canada, the third conclusion from the valuable reports of Mr. Oliphant clearly shows. Indeed, many remarkably prolific new fields are being opened up in the United States in many of the States not before productive, (Kentucky, Tennessee, Louisiana, Texas, Kansas, Colorado, Wyoming, California, etc.,) why cannot the same thing be done in Canada? There is absolutely no question but that it can be done if we only drill and search for these new fields, as they now do in the United States.

As I have advocated, in several communications to the Canadian Mining Institute and to the American Institute of Mining Engineers, and as it is rapidly being admitted now, the origin of oil and of natural gas is a volcanic one, and therefore:—oil and gas were supplied along some of the lines of structural weakness, or along some of the fractured zones of the crust of the earth, and new fields are to be found only along these zones or belt. Many of the fractured zones, or belts, from which our neighbors derive $100,000,000 per year of oil and gas products, extend over into Canada, and if some do not, on the other hand, entirely new belts are indicated in Canada; therefore, the future of these indnstries is most promising in our country, but it is evident that we must drill wells before we can obtain results. Talking and heavy duties alone will not do it, but well directed drilling operations certainly will.

Yours very truly,

Eugene Coste.

Toronto, Ont., April 19th, 1904.

The Ore Deposits of Rossland, British Columbia.

By Edmund B. Kirby, E.M.* (Illustrated by four maps.)

The Rossland Mining District began active production in 1894. Its total yield up to January 1st, 1904, is 1,620,540 tons of smelting ore, containing about $26,000,000 gross value, or $16.00 per ton in gold, silver and copper.

This tonnage was derived from the following mines:

	Approximate Tonnage.
Le Roi	974,785
War Eagle	240,455
Centre Star	229,648
Le Roi No. 2 (Josie and No. 1 Mines)	115,007
Iron Mask	17,655
Rossland Great Western Nickel Plate	12,331
Columbia-Kootenay	7,790
Velvet	5,416
Jumbo	4,395
Giant	4,344
I. X. L.	2,900
Miscellaneous	2,447
Evening Star	1,500
Spitzee	900
Monte Cristo	400
White Bear	302
Homestake	140
Virginia	100
Portland	25
	1,620,540
Estd. Value	$25,816,342
Average	$16.00

The ore is transported to the Columbia river over two competing lines of railway, and supplies extensive smelting works at the town of Trail and at the town of Northport. These towns, together with a population of about 6,000 in Rossland, are thus supported by the mines.

GEOLOGICAL POSITION.

The geological position of these ore deposits is shown by Map 1, which is a slightly modified copy of a map by the Geological

* Paper read before the 6th. annual meeting of the Canadian Mining Institute, March 1904.

Owing to delay of electrotypes, the illustrations for this paper could not be printed in this issue; they will appear in the May issue.

Survey of Canada, from studies by Mr. R. G. McConnell. The elongated oval area of gabbro is surrounded by a border of varying width of augite and uralite porphyrites and fine grained green diabases. The transition from the gabbro to the porphyrites is not well defined, and they are both from the same magma. Beyond the above border come alternating series of porphyrites, tuffs and slates, and beyond these are agglomerates.

The basic coarse crystalline and plutonic gabbro thus surrounded by borders which become more acidic and finely crystalline, and finally pass into volcanic breccia and tuffs, indicates an ancient volcano centre. The gabbro area is the main plug or neck of lava crystallized at great depths and exposed by deep erosion. Its great age is indicated by this erosion and by the numerous alterations in the rock structure and in the rock minerals.

The active mining has been carried on, not within the gabbro area, but outside of it and in the porphyrites surrounding its western end. The principal mines are all included in the small group of claims shown near the edge of the gabbro and located on the flank of Red Mountain, above the town of Rossland. Map No. II is a horizontal section through this group of claims at the approximate elevation of 3,530 feet above sea level. It shows the structure details exposed by the workings of the Le Roi, Centre Star, War Eagle, Josie, Number One and Iron Mask mines. These mines aggregate some 20 miles of total workings, and the principal depths attained are those of the War Eagle, 1,615 feet measured on the vein; the Le Roi, 1,361 feet, and the Centre Star, 1,289 feet.

On the west of these claims there is a belt of fine grained eruptives, probably porphyrites, which are in a schistose condition; having been so plated by pressure as to frequently resemble shale.

COUNTRY ROCK OF MINES.

Within the area of the claims the prevailing rock is evidently all from the same magma, but shows innumerable variations in rate of cooling and degree of metamorphism. It is mainly composed of plagioclase feldspars and pyroxene, generally in about equal proportions, but towards the gabbro area, bodies of pure pyroxenite are occasionally encountered. There is usually a small proportion of orthoclase feldspar and sometimes hornblende, and some observers have noted the fact that these appear more frequently towards the west. The rock appears to be holocrystalline and more or less porphyritic. The crystals may be either microscopic or as large as, say, five mm. while one or two mm. is a common limit. The feldspars are more or less altered to a turbid or porcelain-like appearance, while the pyroxenes are partially transformed to fibrous minerals of the uralite group. In strongly altered places, and especially within the veins, the rock is frequently colored brown from microscopic crystals of secondary biotite.

Although varying considerably in different places, specimens of this rock have generally been determined by microscopical observers as augite porphyrite, and it certainly belongs to the gabbro group, differing from the central area mainly in relative time and rate of cooling. Broadly speaking, the size of crystals tends to increase towards that area, and coarse crystalline masses are more frequently encountered, while in the other direction the structure becomes more fine grained.

DIKES.

This country rock is cut by innumerable dikes which require detailed comparison and determination by the microscope. Generally speaking, they appear to be either mica traps, (perhaps kersantites) or altered basalts (perhaps melaphyre). The latter are often greatly decomposed.

The general direction of the parallel fractures has been north 10° w. with dips, which are either vertical or very steep, to the east. Their detailed fluctuations in strike and dip and the way in which they branch, unite and re-branch are clearly shown by the map. As explained hereafter, they probably belong to at least two periods, one before and the other after the ore deposition. Occasional belts of special crystallization in the counntry rock indicate dikes of an earlier date, which have since become cemented with the country rock and jointed to correspond with it. These have not been mapped.

THE VEINS.

These are shear zone fissures consisting of a series of parallel platings of the rock produced by shearing under high compression. In the Centre Star-Le Roi vein, in which the shear zone is most typically developed, this series of platings is 20 to 40 feet wide and dips about 70° to the northwest. The Josie vein is parallel; but the Centre Star north vein, the War Eagle and Iron Mask veins are branches from the Centre Star-Le Roi vein. Their positions and dips are shown upon the maps.

The ore consists of country rock more or less replaced or impregnated by pyrrhotite, accompanied in places by small proportions of chalcopyrite, pyrite, arsenopyrite and quartz. The pyrrhotite when it occurs by itself, even in solid masses carries, but little gold, say, from $0.50 to $3.00 per ton. The chalcopyrite is the principal carrier of gold, and ore of commercial value occurs only in those localities where chalcopyrite, pyrite and arsenopyrite have been deposited with the pyrrhotite. The manner in which these minerals occur within the interstices of the pyrrhotite, and the fact that continuous masses of pyrrhotite ore are impregnated in some places and barren in others, proves the later deposition of these valuable minerals. They have been introduced after most of the pyrrhotite was in place, although occasional occurrences of chalcopyrite and pyrrhotite in quartz point to the possibility of some contemporaneous deposition. The change from one deposition to another was probably gradual. A small proportion of the gold in the ore is native in the form of small grains and scales. The fact that oxidation extends only a few feet below the surface, while the proportion of metallics seems to average much the same even in ore shipments from the lower levels, suggests original deposition in this form. No data have been collected, however, to indicate whether it was contemporaneous with the pyrrhotite formation.

The average proportions of gold, silver, copper and total sulphides in a grade of, say, $15.00 full assay value are as follows:—

	Average Centre Star Ore.	Average War Eagle Ore, Representing also ore of Number One, Josie-Le Roi.
Gold, (oz.)	0.59	0.505
Silver, (oz.)	0.43	1.0
Copper, (%)	1.12	1.78
Sulphide Minerals, (1%,)	25.0	22.5

In various places the pyrrhotite seems to be accompanied by a little nickel and cobalt. Specimen analyses ranging from 0.13 to 0.65% nickel, and from a trace to 0.59% cobalt.

FAULTS.

These have an average direction which corresponds to the dike system, with dips ranging from vertical to 50° easterly. Out of the great number of fractures studied and surveyed only the principal faults have been plotted, i.e., those fractures which appear to have affected the veins by well defined displacements or by acting as barriers to mineral solutions. The map gives only a

partial idea of the way the main faults branch in strike and in dip, and of the numerous minor interlacing fractures which connect them. In certain localities it will be seen that the ground is hopelessly shattered.

The faults are frequently not plainly marked, having no clay filling, and at most only a small thickness of comminuted material. They frequently consist of a zone or series of close fractures, some of which are better marked than the others, and these fracture planes often interweave in such a manner that local measurements of their strike and dip are deceptive, and these can be determined only by comparison with other workings. As a general rule, the faults appear to have been too tightly compressed to give access to mineral solutions, and those existing during the deposition period have therefore tended to act as barriers to the flow of these solutions.

Since individual faults often cross dikes at sharp angles in strike and in dip, a fault frequently breaks along a dike for considerable distances. Hence in many cases of vein displacement it is impossible to say how much of the total amount has been due to the dike fracture, and how much to subsequent fault fractures accompanying it. In most cases where dikes are not accompanied by plainly marked fracture planes the displacement is so small as to indicate that the fault system, and not the dike, has probably been responsible for most of the shifting.

The sharp angles at which the faults cut the War Eagle vein have tended to produce overlaps of the vein, which is most clearly disclosed in the case of fault (K) on upper levels.

The Josie and Centre Star-Le Roi vein, being crossed more squarely by the fault system, afford the best indications of its effects. The Josie dike, or more probably an undetermined fault accompanying this dike, have caused a displacement, which is indicated in the Josie and Number One to be a north throw going east. Proceeding east from fault to fault they are found to have the same throw up the faults (I and J) at the junction of the Le Roi-Centre Star territory, after which the steps occur in the other direction, with a throw to the south. On reaching fault (Q) a north throw is again encountered, and the steps to fault (T) are then south, north, north. The large scale reversal often stopping in both directions from faults (I and J) indicates a lifting of the blocks from this centre, the possibility of which is borne out by various connections of the fractures between faults (H) and (K), indicated in lower workings. As explained hereafter, much of the faulting occurred after the ore deposition and also at a later date than the dike formation.

DISTRIBUTION OF ORE AND ORE SHOOTS.

The pyrrhotite mineralization has been very abundantly distributed through the larger veins, but the secondary disposition of gold and copper bearing minerals has been more localized, occurring in the more favorable places. The bodies of valuable ore thus found are sometimes lenses, tapering out at the edges, and sometimes blocks terminating against faults or dikes. These ore bodies are found distributed within more limited portions of the vein area, which in the practical sense thus constitute the ore shoots, and indicate those portions of the area to which the gold and copper bearing solutions had the best access. The shoots are upon a large scale and of such irregular form that their shape and limits have been developed very slowly, and the largest and best defined up to the present date are those of the War Eagle, Centre Star and Le Roi mines.

The War Eagle shoot has a dimension of 300 to 450 feet along the vein, and an almost perpendicular trend upon its plane. It is so located that its median line roughly coincides with the line of the main shaft.

The Centre Star main shoot is located in the space between the shaft and the Le Roi end line, and appears to have a dimension of 300 to 500 feet along the vein, with a steep trend to the east. The Centre Star east ore shoot is several hundred feet east of the shaft, but has not yet been sufficiently developed to determine its length along the vein or its trend, although the latter now appears to be either perpendicular or very steep towards the east.

The Le Roi ore shoot on the 350 foot level stands near the east end of the claim, as shown in the map, and descends perpendicularly, then assuming a westward trend. A little below the plane of the map it stretches out so as to include the entire distance between the Josie dike and fault (1), as illustrated by Map III of the Le Roi 700 foot level. The structure of the shoots and of the pay ore bodies within these shoots everywhere points to the conclusion that their location and shape are due entirely to the accidental conditions directing the upward flow of the mineral bearing solutions.

The marked difference between the proportions of gold, silver and copper in the Centre Star ore shoots and those of the other mines suggests that the solutions in the Centre Star came from a different region than those which furnished the other deposits. The fact that the Centre Star was somewhat nearer to the volcanic centre than the others, and that its ore shoots trend in that direction, may account for this.

These shear zone fissures, more or less shattered by repeated movements, have afforded permeable channels for the ascending mineral solutions, which have penetrated and decomposed the country rock, replacing its rock minerals wholly or partially by metallic minerals. In places the entire width of the shear zone has thus been transformed into ore, while in other places the mineralization has been narrow. The solutions have frequently jumped across from one set of plating fissures to another, shifting the pay streak from the hanging to the foot side, or to intermediate positions, as the case may be. In the Centre Star-Le Roi vein the foot wall fissure is the one which is the most regular and distinct, and is marked by a vein of small interlacing calcite seams, which has been found a very reliable indicator of the position of the vein. As a rule the heaviest ore deposition has taken place near this foot wall, and mineralization extends to irregular distances on the hanging side, gradually fading into the country rock. In the War Eagle vein the hanging wall is generally the most distinct and best mineralized, with irregular extension into the foot wall side.

While many of the dikes and faults merely occasion small displacements, with no effect upon the mineralization, a number of them evidently occurred before this mineralization was begun, or at least before its completion, and acting as partial barriers to the flow have so deflected the solutions as to greatly increase the deposition on one side, although they have not themselves been mineralized. Map IV of a portion of the War Eagle 6th level illustrates the way in which solutions rising through the fractured ground, caused by a fork in the vein, have been stopped by a large dike, and were so deflected and accumulated in rising along its under side as to produce exceptionally large and rich ore bodies. In the Josie vein the Tramway dike has in a similar way produced the Annie ore shoot below the plane of the map, and the Josie dike has had the same effect upon the Le Roi and Black Bear veins (see Map III). In both these veins the solution towards the west end seem to have been more or less confined to the space between the Josie dike and the partial barrier afforded

by fault (D). Between (D & E) the ore bodies are smaller and less frequent. The principal channel for solutions has been between faults (E) and (I), where large masses of ore have formed, reaching widths of 100 feet up against fault (E). The same phenomena are repeated throughout the Centre Star ground, as exhibited by Map II, which everywhere shows the tendency of such mechanical barriers to deflect or accumulate the solutions. In the Centre Star it will be noticed that the principal channel has been that portion of the vein between fault (K) and fault (Q). Fault (K), however, notwithstanding its large displacement, has for some reason been an imperfect barrier. In the lower levels heavy deposition has occurred on both sides of it, while on the second level, shown on the map, it has been mainly on the east side, and, at this horizon, is also accompanied by a deposition of ore along the plane of the fault. This is rather exceptional, and in fact is the most clearly marked case of deposition within fault planes. In the few other instances there is some doubt as to whether the material is not dragged ore or an original vein. As a rule, the faults do not appear to have been very accessible to the solutions.

The numerous instances of displacements by faults and dikes where the severed portions of the vein on each side are alike, prove that some of the dikes and some of the faulting occurred after the ore formation. If the dikes were studied in detail and classified they would probably be found to belong to two or more different periods, some of which were later than the deposits. As to faults, the facts observed accord fully with what is known of dynamic action during the long period while volcanic activity is expiring. Shocks and movements occur repeatedly at increasing intervals. Early fractures would afford planes of weakness which would not only be kept open by the repeated movements but would be multiplied and extended by branches and interlacing fissures. Such action probably continued long after the ore deposition and also after the dike formation, since these are found to be cut by faults.

It is very noticeable that the later solutions introducing the gold and copper bearing minerals with quartz have as a rule followed the pyrrhotite deposition, and do not seem to have sought or found new permeable channels in the rock where these minerals might deposit by themselves. On the contrary, they seem to have been unmistakeably restricted to the ground already impregnated with pyrrhotite, and the greatest enrichment has as a rule occurred where the previous pyrrhotite deposition was most extensive.

There seems no reason to believe that the pyrrhotite had chemically any more influence on the subsequent deposition than ordinary country rock would have. It may have been that the friable pyrrhotite ore presented such local weaknesses as to become especially shattered by subsequent movements, and thus afforded the most permeable channels. What probably occured, however, was that there was one continuous flow which gradually changed in chemical contents and conditions of deposition. The altered solutions at the time of the secondary deposition merely followed the channels of flow which were already established, possibly modified more or less by a refracture or brecciation of the pyrrhotite ore.

CONCLUSIONS.

The conclusions derived from a study of these deposits are as follows :—

(1) The pyrrhotite was deposited from aqueous mineral solutions ascending through the more fractured and permeable portions of the shear zone fissures.

(2) The gold bearing chalcopyrite, pyrite and arsenopyrite with quartz were deposited later from the same flow rising within the same channels but restricted to those portions of the channels which still remained unfilled, or which were re-opened by further fracturing of the friable pyrrhotite ore.

(3) The main faults and some of the dikes existed before the formation of pyrrhotite began, or at least before its principal deposition.

(4) Their intersections with the shear zones made barriers which more or less directed the flow, accumulated the solutions, and determined the position of the main ore bodies.

(5) After the ore formation more dikes appeared. Faulting was repeated intermittently, continuing probably up to recent times, and the early fractures were kept alive.

The writer is well aware that the origin of pyrrhotite is still in dispute by eminent authorities, but believes that a study of the Rossland deposits must remove any remaining uncertainties as to this question. All observations, from the occurrences of the pyrrhotite as mineral replacements, veinlets and films in the rock to the effect of dikes and fractures in massing its formation, point to deposition from mineral solutions. In these deposits at least, it is impossible to even consider "direct igneous origin" or "magmatic segration," and no evidence has been found to suggest any difference between their origin and that of ore deposits of pyrites or other minerals whose genesis is now established.

The evidence does show, however, that the conditions necessary for pyrrhotite deposition prevailed at an earlier time than those required for chalcopyrite, pyrite, arsenopyrite and quartz. It is well understood that during the period while heated waters are ascending in the vicinity of cooling eruptive masses the chemical contents of the solution slowly change, and so do the conditions of deposition. For the same flow to first yield pyrrhotite, and then so alter as to produce the other minerals, is no more exceptional than the well-known excessive deposition in veins of the more common minerals. It may be that the only difference between their origin and that of pyrrhotite is that the latter requires exceptional depth, heat and pressure. The heat would be greatest during the earlier stages of circulation, and the great erosion noted by the Geological Survey indicates the prevalence of unusual depth and pressure at the time.

EFFECT OF STRUCTURE UPON MINING METHODS.

Map II illustrates the peculiar difficulties presented to exploration work within an ancient volcano. Every dike and every zone of fissures constituting a fault creates a gap or blank in the formation and to these are added the gaps due to vein displacement. Systematic cross cutting aided by diamond drilling is necessary on account of these displacements, vein-branching, the variations of vein thickness and the shifting of ore from one set of planes to another. If carelessly placed a cross cut or drill hole encounters so many of these blanks as to afford no information, or what is worse, indecisive results. It is very difficult to make such work efficient, and it calls for every resource of care and skill.

In the War Eagle and Centre Star mines structure details are carefully kept up, and it is endeavored, so far as possible to make cross cutting effective, to avoid work in belts ofdike systems or belts of shattered ground, and to direct the principal explorations to the main channels of flow.

ACKNOWLEDGMENTS.

The structure details of the maps are by Mr. Carl R. Davis, E.M., Superintendent of the War Eagle and Centre Star Mines, and Mr. Hugh Rose, A.B., Mining Engineer. The writer also

desires to acknowledge the friendly assistance and courtesy extended to him by Mr. S. F. Parrish, Manager of the Le Roi Mining Co., Limited, and Mr. Wm. Thompson, Manager of the Rossland Kootenay Mining Co., Limited, and Mr. Paul S. Couldrey, Manager the Le Roi No. 2 Mining Co., Limited, who have freely placed at his disposal all the data and information in their possession concerning the structure of these deposits.

Acid Making From Pyrrhotite.

By Ernst A. Sjostedt, Sault Ste Marie, Ont.

Attempts at using pyrrhotite (monosulphide of iron, $Fe_6 S_7$) instead of brimstone or pyrite (bisulphide of iron, $Fe S_2$) for acid making have often been made, but the same having repeatedly ended in failure and disappointments, they finally come to be considered as useless and foolhardy undertakings ; and some engineers and professional men have even gone so sar as to publicly pronounce it an impossibility, as will be seen from the following quotation :—

" One of the most serious errors ever perpetrated in the manufacture of acid from pyrites is the atttempted employment of pyrrhotite for pyrite. Aside from the greatly lessened proportion of sulphur, 36% as against 53%, the pyrrhotite will not even yield freely what sulphur it contains, but crusts with oxide of iron, turns black, and is soon extinguished when treated in an ordinary pyrite kiln. It seems scarcely possible that extensive works for the manufacture of acid should have been erected, their supply being entirely derived from a deposit of the valueless monosulphide, but such has been the case in more than one instance, and will continue to be so in enterprises conducted without skilled direction."

When, therefore, a few years ago the problem was presented to us of treating the Sudbury pyrrhotite so as to recover not only the nickel, cobalt and copper present, but to utilize its sulphur and iron contents as well, no sympathetic co-operation was to be expected, and open criticism was heard from many quarters. It is with a feeling of no small amount of satisfaction, therefore, that we are now able to announce that the question of economically using the sulphur from said ore has been solved ; and take pleasure in herewith presenting such information and data as will prove to the engineering fraternity the value of the work done, and the importance of the results obtained.

THE PROBLEM.

The Sudbury pyrrhotite, as shipped for smelting purposes averages about 15—20% suiphur, 1—3% nickel and .5—2% copper, the balance being made up of a corresponding percentage of iron and gangue. Realizing the impracticability of using such low grade ore for the purposes set forth, the first step taken was in the direction of concentrating it. The pyrrhotite being easily distinguished by its pale color from the deep yellow chalcopyrite, the separation of the same from the copper ore and the gangue was readily accomplished in the rock house, at the crusher and on the sorting table ; and in this separation we obtained two workable grades of ore, one high in copper and gangue and low in sulphur, designed for the ordinary matte smelting process, and the other, low in copper and gangue but high in sulphur and nickel, intended for the acid plant. This latter grade usually averages about 28% sulphur, 3% nickel, .5% copper and 50% iron,

The plan proposed for utilizing the sulphur in this ore was to roast the pyrrhotite in a closed furnace, with the recovery of the resulting sulphur dioxide gas, which, after having been cleaned and cooled, was to be used for the following purposes :

1. In the manufacture of a " bisulphite liquor," of a character suitable for, and to be used in, the sulphite pulp industry.

2. In the manufacture of liquid sulphurous anhydride, intended as a reserve supply for the sulphite mill in case of any stoppage or interruption at the roasting plant, or when the pulp mill would call for more or a stronger gas than that furnished by the roasters in operation ; also intended as a separate commercial product to be disposed of for the purpose of refrigeration, ice making, sugar refining, bleaching, disinfecting, etc.

3. In the manufacture of sulphuric acid—50°B, 66°B and 98% strong—for the great market open to such an industry, covering an extensive field from fertilizers to gold mining, and including manufacturers of fertilizers and soda water, oil refiners, dyers, furriers, cotton bleachers, brewers and galvanizers ; and also for the rubber and hat trade, the woolen and wire mill ; the nitroglycerine and dynamite manufacturers.

THE ROASTING PLANT.

The question of greatest importance at this stage, consequently, was to find a method or roasting system by means of which a clean and sufficiently strong gas could be obtained at smallest cost. Roasting experiments were, therefore, carried out in a systematic manner in shaft and reverbatory furnaces ; and the first conclusion reached was that the ore, in order to be successfully treated, must be crushed to a powder. It now happened that at this time the Herreschoff roaster for treating pyrite fines was brought to public attention, and receiving some encouragement from the designer as to the feasibility of this furnace accomplishing the desired aim (a dead roasting of the ore without any auxiliary heat), one of these roasters was purchased and erected at this place for trial purposes. In spite of every effort, and after a long series of tests, however, we found that this roaster, as constructed, would not answer our purpose—the roasting heat not being maintained by the combustion of the sulphur in the ore, and the gas produced being too diluted. The many excellent points embodied in this type of roaster being fully appreciated, attempts were at first made simply to improve on the weak points as applied to our special problem, but gradually a somewhat different type was evolved, containing some important changes, thanks to which the problem was eventually solved. These modifications consist of (1) a minimizing of the heat of radiation, (2) the application to best advantage of the roasting heat generated, (3) the exclusion as far as possible of an excess of air over and above that required for the oxidation of the sulphur in the ore, and (4) the application of an auxiliary source of heat, in case of need. And the special features embodied in the new roaster are the following :—

1. The combination of four single furnaces in one battery, disposed equidistant from a common centre.

2. A minimum distance between the floor and roof arches of the roasting chambers, made possible by the construction of the arm, and the manner in which it is secured to the centre shaft (it being secured in position by a horizontal motion and a quarter turn).

3. A round rabble arm, with a perfectly secure locking device having both ends closed so as to prevent any inflow of air from the centre shaft to roasting chamber ; the air of combustion being admitted through special pipes, provided with valves for a perfect control of the same.

4. Separate muffle chambers for the application of an auxiliary heat, and having no connection with the roasting chambers, the one under the bottom hearth being a combustion chamber, and those under the second and top hearths being heating chambers,

* Paper presented at the sixth annual meeting of the Canadian Mining Institute, March, 1904.

through which the combustibles of the extraneous fuel pass from the combustion chamber, and thus utilized to advantage in heating the corresponding roasting floors.

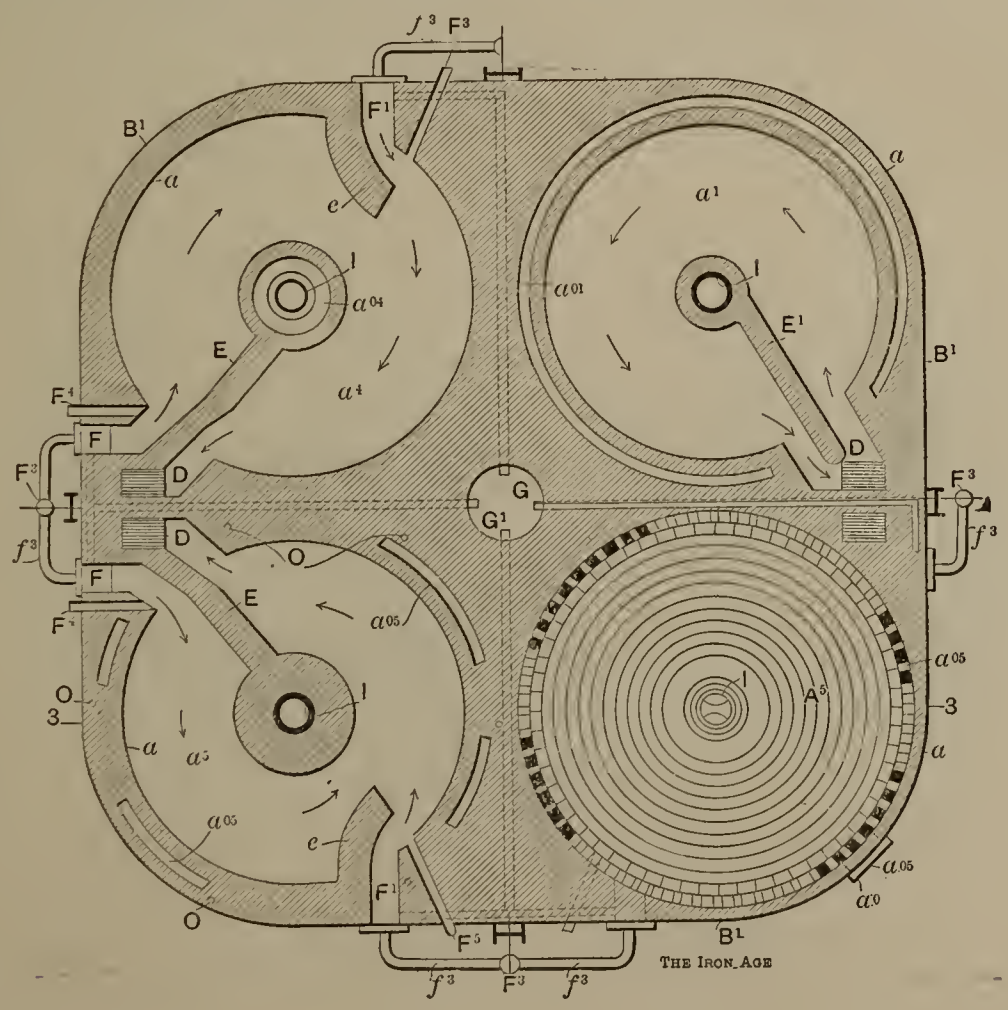
5. A screw device for feeding the ore from the hopper to the roaster, the same being propelled by means of an endless chain from the main driving shaft.

This roaster is shown in Figs. 1 and 2. Fig. 1 presents a battery of four furnaces in horizontal cross section on broken lines, 1——1, 1′——1′ and 2———2 on fig. 2, showing the combustion chambers a^5, the lower and upper heating chambers a^4 and a^1, and the lower or discharging hearth A 5; fig. 2, shows a sectional elevation of the battery on lines 3————3, on fig 1, through the central columns of the furnaces, one side shown with the rabbles and one without. A1—A5 are five straight arched hearths, and a^1, a^4 and a^5 the combustion and heating chambers. The flow of the fuel gas and combustibles is indicated by arrows. The gas or oil, entering from main F3, through branch F3 and a suitable burner into the combustion chamber at F and F1, strikes the hot baffle walls and is readily ignited, passes through the chamber and reaches the flue D, which leads to the heating chamber a4 over the lower roasting hearth. This chamber also being provided with a baffle wall E, which extends to and surrounds centre shaft 1, separating the gas inlet from its outlet, the combustibles are compelled to make a full turn here before passing out and up through the upper section of chimney flue D to heating chamber a1. Here it makes a similar circuit before finally passing out through the last section of D and flue D1, to stack K, which is in common to the whole battery of four roasters. F4 and F5 are peep holes, for inspecting the heat and the combustion in the heating chambers. G is an air receiver ("hot blast") in the centre of the battery into which the air of combustion is introduced under pressure and heated from the brick walls with which it is surrounded, and thence carried through blast pipes B2 to burner at F. The ore finely crushed is introduced through an opening in the top of roof A of the upper roasting chamber to the hearth A1, by feed tube n, provided with an automatic screw charging device nl. Owing to the bottom heat furnished by the heating chamber aL, the ore is soon dried and is now moved towards the circumference by the teeth of arms L, fastened to the revolving centre shaft I, and finally drops down on hearth A2 through rim discharges a o 1. The arms of this hearth, having their teeth placed in opposite directions to those in hearth a1, now cause the ore to move towards the centre, and discharges it through centre openings ao2 on hearth a3, and the ore is thereupon moved towards the circumference, drops through ao3, on the shelf a4, is then moved towards the centre and discharged on shelf a5, and finally through ao5, and spout ao6 in the ore conveyor. O are pipes admitting and controlling the air supply for the roasting of the ore, and M is a cast iron pipe leading from the top of arch A of each roaster and through which the sulphurous gases pass out from the roaster to the main gas flue.

Four of these batteries of kilns—16 units—have been built, with a total capacity of treating forty tons of ore per day; also a crushing plant has been installed, consisting of one 24″ x 15″ jaw crusher, two 36″ rolls and two revolving screens of No. 16 mesh, with a capacity of pulverizing about 80 tons of ore per shift of 10 hours ; also two Dellwik-Fleischer No. 4 water gas generators, each having a capacity of producing 20,000 cubic feet of water gas per hour, or with a total capacity of about 800,000 cubic feet per day; also an electric installation of three 95 h.p. General Electric motors for supplying the required power.

THE ROASTING GAS.

At first water gas was used as an axiliary fuel, but by gradually improving the details of the roasters and gaining in experience we finally succeeded in doing without it, and since then have roasted our pyrrhotite without any extraneous fuel (even at times when the sulphur in the ore averaged but 20 to 25%, producing a gas of sufficient strength 6-10% SO_2), for making bisulphite liquor and liquid SO_2 ; also a fairly well roasted ore, running as low as 20% to 75% S when admitting a liberal amount of air and obtaining a weak gas, but generally from 1% to 3% S when producing a good gas.



A glance at the chemical reactions taking place in burning sulphur and in roasting iron sulphides will assist in forming an intelligent idea of the maximum strength of gas obtainable, as well as of the efficiency and significance of a 10% SO_2 gas from pyrrhotite.

When burning sulphur: $S+2O=SO_2$, i.e., all the O combines with the S to form SO_2. When burning pyrite: $2\,FeS_2 \times 11\,O = Fe_2O_3 + 4\,SO_2$; i.e., 8 parts of O out of 11 unite with S to form SO_2. When burning pyrrhotite: $Fe_6S_7 + 23\,O = 3\,Fe_2O_3 + 7\,SO_2$; i.e., 14 parts of O out of 23 unite with S to form SO_2. When burning pyrrhotite: $2\,FeS + 7\,O = Fe_2O_3 + 2\,SO_2$; i.e., 4 parts of O out of 7 unite with S to form SO_2. The roasting being accomplished by means of air instead of undiluted oxygen, (containing 21% O, by volume), we readily find that the highest theoretical percentages of SO_2 obtainable are the following:—when burning sulphur, S: $21 \times 2 \div 2 = 21\%$ SO_2 max. When burning pyrite, FeS_2: $21 \times 8 \div 11 = 15.27$ SO_2 max; when burning pyrrhotite, Fe_6S_7: $21 \times 14 \div 23 = 12.78$ SO_2 max; when burning pyrrhotite, FeS: $21 \times 4 \div 7 = 12.00$ SO_2 max.

The annexed tables from our daily records of two weeks run in February last, during which time we used pyrrhotite only (and that of an inferior grade) will furnish exact data of results obtained under such circumstances.

Composition of ore used, average sample taken from each 40 ton lot.

	a	b	c	d	e	Average
Insol	24.74	29 20	24.95	21.03	16.10	22.50
Sulphur	26.30	23.81	24.67	27.60	29.90	24.46

Roasting Results, (average of tests made each hour).

February	11-12	13-14	15-16	17-18	19-20	21-22	23-24
Strength of Gas, % SO_2	8.60	8.30	7.90	7.90	7.40	7.60	7.70
Roasted Fines, % S	1.66	1.86	2.04	2.54	1.78	0.95	1.86

During these two weeks we treated 210 tons of pyrrhotite, containing 111,112 lbs. of sulphur, and recovered 191,917 lbs. SO_2, thus obtaining an efficiency of 86%. The average working cost, exclusive of heating and lighting the building, amounted to $1.86 per ton of ore treated, distributed as follows:—

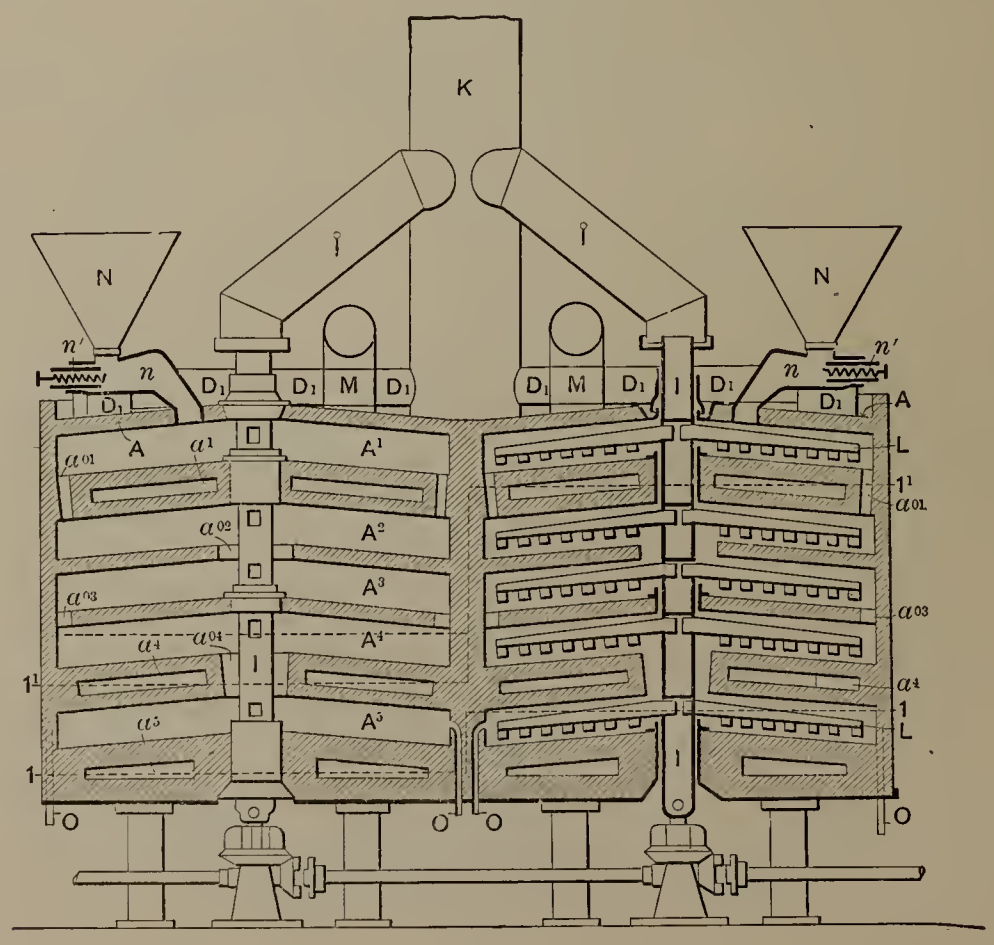
Labor	$1.12	Crushing	.50
Power	.24	Roasting	.75
Repairs and sund..	.50	Sup. rep. and sund..	.61
	$1.86		$1.86

If to this amount we add depreciation of plant (say 14 cents per ton), the cost of the raw ore (say $5.00 per ton) and the cost of briquetting the fines (say 75 cents per ton), and then subtract the value of the briquetted ferro-nickel ore, (which we will assume to be equal to that of the unroasted ore, or $5.00 per ton), we obtain a total of $2.75 as the cost of 914 lbs. SO_2, equal to a rate of $6.00 per ton of SO_2 gas recovered, corresponding to $12.00 per net ton, or $13.44 per gross ton, sulphur.

It may be well to state here that at first no other raw material than pyrrhotite was used for the acid making, but some valuable deposits of pyrite having been discovered in close proximity to the company's iron mine, it was decided to use some of it at times when treating a low grade pyrrhotite, or when an extra supply of gas would be required. During the last half year's run a few hundred tons of brimstone were also used, on account of shortage of both pyrrhotite and pyrite from the mines—(caused by the company's financial condition at that time). Altogether 10,000 tons of pyrrhotite and 3,000 tons of pyrite have been roasted in these kilns, and 375 tons of brimstone used as raw material at our acid plant up to the present time.

THE BISULPHITE LIQUORS.

Tilghman, in his patent involving the use of sulphur dioxide in reducing wood to pulp, states that his invention consists of a process of treating vegetable substances, containing fibres, with a solution of sulphur dioxide in water,. either with or without the addition of sulphites, heating the same under pressure in a closed vessel to a temperature sufficient to cause it to dissolve the intercellular incrusting or cementing constituents, leaving the undissolved product in a fibrous state, suitable for the manufacture



of paper pulp etc. Owing to the smaller absorption of the sulphur dioxide by water, than by a watery solution of metallic oxides, such as soda, lime or magnesia, the practice in pulp making is therefore to make use of such solutions in different ways—the system in use here being what is called the "tower system." This consists of a battery of high towers filled with a coarsely broken dolomitic limestone, through which runs a spray of cold water, while the roasting gas is forced up through the tower, meeting the weak lime solution thus formed, and is absorbed by the same, forming monosulphite of lime ($CaSO_3$) and magnesia; and upon the neutralization of the lime by the gas, the water absorbs free SO_2, forming an acid solution (H_2SO_3) which again dissolves some of the lime and magnesia salt, resulting in the formation of a solution of monosulphite of lime and magnesia in free sulphurous acid (H_2SO_3)—the so called "bisulphite liquors." The desired strength of this solution is about 4% total SO_2 and 1% lime (5.5°B); and our experience here has taught us that for economically obtaining such a liquor a minimum of 5% SO_2 in the roasting gas is required.

The gradual progress and improvement made in our work in this department will best be seen from our first year's record hereby presented.

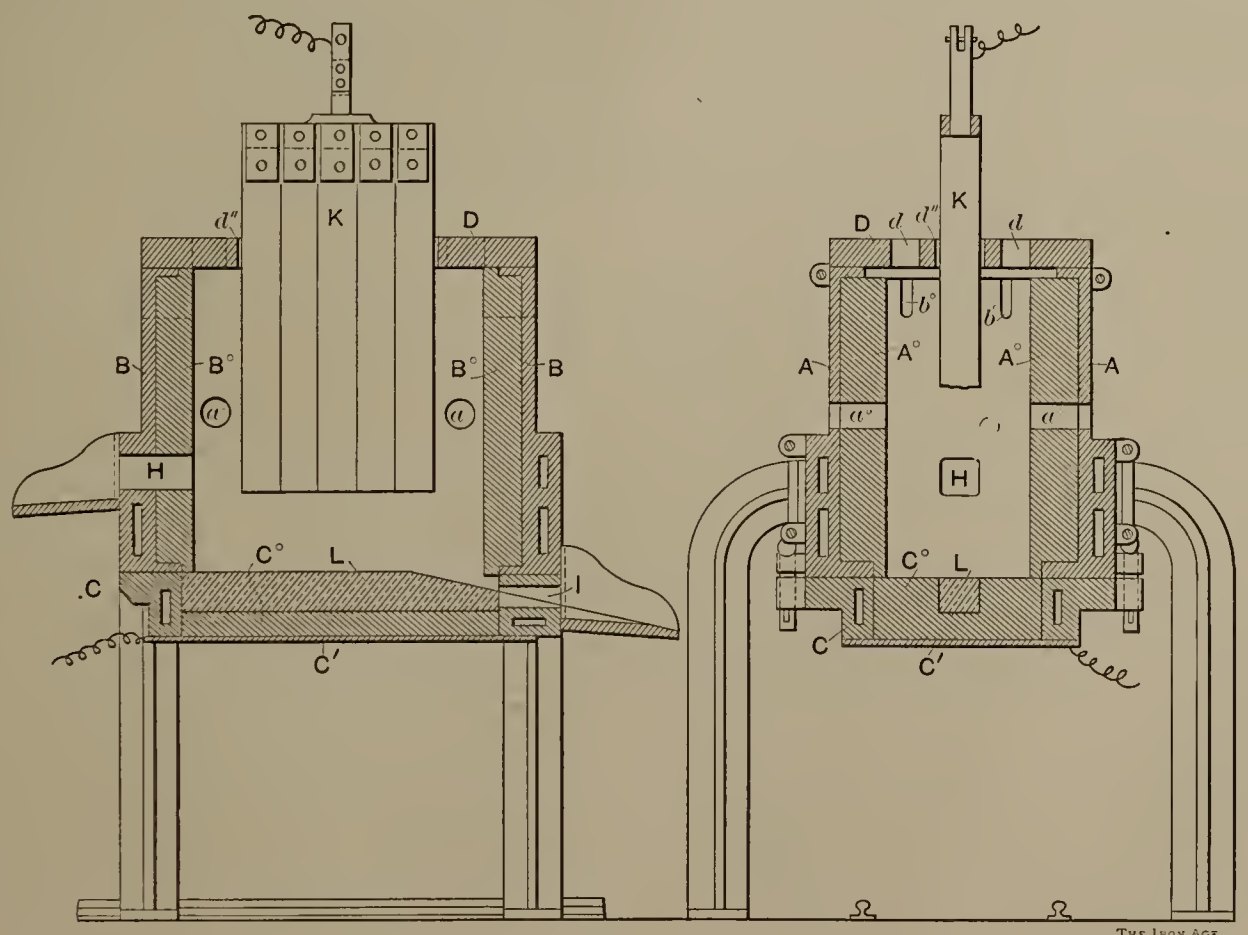
	Tons SO_2 made.	Tons SO_2 recovered.	Av. Strength of gas,% SO_2	Efficiency of recovery.
January	228	163	5.9	71.4
February	208	107	4.7	51.4
March	221	165	5.3	74 9
April	249	173	4.7	69.3
May	197	125	4.1	63.2
June	250	163	5.0	65.6
July	265	125	4.6	60.3
August	265	117	5.1	44.3
September	285	205	6.6	71.8
October	241	205	6.7	85.3
November	252	221	8.1	87.0
December	260	255	12.6	97.0

This table also shows that from January to July inclusive the gas supply was constant but weak, and the absorption not sufficient (66%); also that during July and August, when the weather was warm, the efficiency was still more unsatisfactory, being only 52%; but that, after the installation of a larger cooler in August, a great improvement in the absorption was had, September showing 71.8% and October 85.3% efficiency; and finally that in December, when using part pyrite, a much stronger gas was obtained, and also (owing to the low average temperature (38°F) of the absorption and cooling water during this month), a nearly theoretical recovery of the gas—97% efficiency. Later on, after having made further improvements at the roasting and the absorption plant, we succeeded in producing an 8% SO_2 gas from pyrrhotite with less than 25% sulphur (as previously shown), and found subsequently no difficulty in making a gas of 8%-10% SO_2 contents from a rich (30%S) pyrrhotite, and in obtaining a recovery efficiency of 70%-80%.

THE LIQUID SO_2 PLANT.

The principle underlying the liquifaction of diluted sulphur dioxide gas is quite simple, consisting merely in the absorption of the SO_2 by water (thereby separating it from the nitrogen and oxygen and other gases with which it is diluted), heating the acid solution obtained, so as to evaporate off the SO_2, dehydrating this acid gas, and compressing and cooling the dried gas. In practice, however, many difficulties present themselves for an economical solution of the problem, caused principally by the low degree of solubility of the gas in water of high temperature, and the poor absorption of a very dilute gas. The annexed table shows some of the values regarding the SO_2—gaseous and liquid—at different temperatures:—

Temperature. °C	Temperature. °F	Vol SO_2 soluble in 1 vol. H_2O	% SO_2 in a saturated solution	Sp. gr. of the watery solution	Pressure (in atms.) of the liquid SO_2
10	14				1.00
0	32	79 8	18.58		1.53
5	41	67.5	16.19	1.061	1.80
10	50	56.6	13.93	1.059	1.26
15	59	47.3	11.92	1.054	2.70
20	68	39.4	10.13	1.042	3.24
30	86	23.4		1.024	4.12
60	140				10



The Iron Age

The above figures are correct only when dealing with 100% gas as the solubility of the diluted gas is much smaller. For instance : A 10%-12% volume SO_2 in the roasting gas will, at ordinary temperature give a max. absorption of only 2% SO_2, instead of the 10%-15%, shown at temperatures between 10-20 °C.

The requisites for an economical liquefaction, therefore, are as follows :

1. A strong gas, and gas flues free from leakage.
2. An effective cooling and cleaning system.
3. Cold water for absorption and cooling.
4. Large absorption towers.
5. An economical heating exchange (counter current) system.
6. Cheap fuel and economical heating and concentrating systems.
7. Ample compressor capacity.

All the above points have been carefully studied and applied in our liquefaction plant, the general arrangement of which is shown by the annexed sketch Fig. 3.

The roasting gas from furnace A rises to gas main a, and is from there drawn off by means of a lead lined fan D, through a cooler B, and spray tower C, and then forced through absorption tower E, where it meets a shower of water, by which it is absorbed, leaving the nitrogen, oxygen, and other gases to escape at c. The acid solution leaves the tower at e, and runs by gravity through pre-heater F, overflowing through pipe f, into heating pan G, where it obtains its final temperature for driving off the SO_2 contents, and from which the hot spent liquor runs through pipe f back to the pre-heater. In this apparatus, built on the counter current and heat exchange principle, the outflowing spent liquors give up their heat to the inflowing cool acid solution. When brought near boiling point, the solution gives up its SO_2, which then, together with some steam, rises up through the gas out-take g, to condenser H, where most of the vapor is precipated, and then to the dehydrating tower I, where its last trace of moisture is absorbed by the strong sulphuric acid entering the tower through pipe K. This acid, on being diluted by the absorbed water, runs by gravity through pipe i' to acid pan J, where it is evaporated and concentrated to full strength, and run off through j into acid eggs K, from which it is again forced through k back to the dehydrating tower. The now pure and dry SO_2 gas passes through suction pipe i to compressor L, where it is subjected to the required pressure ; is then cooled and liquified during its passage through discharge pipe l and cooler M to storage tanks N. From these tanks the SO_2 can either be drawn off in liquid form at n', or in gaseous state at n", as desired.

With roasting gas of 7%-9% strength, and with the cooling and absorption water with a temperature of 40°-45°F we obtain an absorption of 70%-80% efficiency, and maintain the strength of the acid solution at 1.2–1.5% SO_2, the temperature of the gas entering the tower being 70°-80°, and the solution leaving the tower at about 45°F, entering the preheater at about 165°, is here further heated by exhaust steam to about 188°, and thus the balance of only 24°F needs to be furnished by direct fuel.

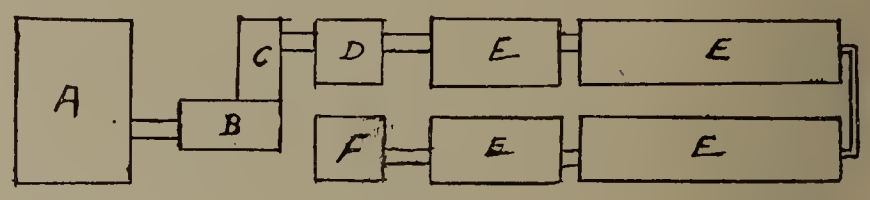
The capacity of the plant is from 8 to 12 tons of liquid acid per day, and the cost of liquefaction includes the following items :

Fuel	$1.00 per ton	
Power (Electric)	1.00 "	
Water, light and incidentals	1.00 "	
Labor and superintendence	1.75 "	
Depreciation and repairs	1.25 "	
		$ 6.00
2 tons SO_2 gas at, say $8.00		16.00
Total cost of one ton of liquid SO_2		$22.00

THE SULPHURIC ACID PLANT.

Sulphur dioxide gas, in presence of free oxygen and steam will form sulphuric acid ($SO_2 + O + H_2O = H_2SO_4$). For this industry a weak gas is not only permissible, but even necessary, a surplus of oxygen being required. In fact the the sulphuric acid makers do not want any stronger gas than 8% SO_2, while one of the most prominent consulting engineers has advised us that even "from 5%-6% SO_2 gas sulphuric acid can be produced, at a very low cost, that will compete with any manufactured from pyrite."

In the manufacture of sulphuric acid two systems are now in use, namely, the Chamber system and the Contact system ; but the one especially recommended to us is the old Chamber system. As planned, this plant will have a capacity of 30 tons 50° B,-21 tons 66° B, acid, and will be arranged in the following general manner :—



The gas from roasting furnace A enters first into nitre oven B, where it is mixed with nitrous vapors, then to dust chamber C, hot tower D and lead chambers E, where, under the influence of steam and at the expense of oxygen of the nitrous acid, it is converted into nitric oxide and further oxidized (by the air present in the chamber) into nitrous acid, which again decomposed by SO_2 etc.—the process being continuous. From here the sulphuric acid formed passes through cold tower F, filled with coke, where it is freed from its mixture of nitric and hyponitric acids :

($SO_2 + N_2O_3 + H_2O = H_2SO_4 + 2\,NO$)

The daily cost of manufacturing a 50° B, acid from pyrrhotite or pyrite in the above named plant would include the following items :—

	Pyrrhotite 30% S	Pyrite 45% S
Pyrrhotite, 25 tons at $25.00	$125.00	$
Pyrite, 15½ tons at $5.00		77.50
Nitrate of Soda, 420 lbs. at $2.25	10.50	10.50
Steam	10.00	10.00
Labor	8.00	8.00
Repairs, 25c per ton S	1.75	1.75
Depreciation, 10% on $50,000.00	15.75	15.75
Total cost	171.00	124.00
Deduct values of the roasted fines	100.00	15.50
Net cost per day	71.00	108 50
Net cost per ton 50°B Acid	2.37	3.62

CONCLUSION.

From the data above given we find that the pyrrhotite not only can be roasted without the aid of special fuel, but also made to yield a sufficiently strong SO_2 gas for the sulphite pulp industry, for liquefaction and for the manufacture of sulphuric acid, thereby giving to this much neglected mineral a value and an opportunity which it never had before.

But before concluding, I wish to explain my position in this respect, and to state that my contention is not that pyrrhotite necessarily is the most economical raw material for the acid industries under all circumstances, but simply that, when a pyrrhotite, containing some other valuable elements, such as nickel, cobalt and copper, and where the prevailing practice is to roast

the same before smelting, and when a deposit of magnetic pyrites can be obtained at the cost of mining and used for local consumption, the monosulphide of iron stands a fair chance of being a cheaper source of sulphur for the above mentioned industries than brimstone, or pyrite bought at market price at a distance—and consequently making many magnetic pyrite deposits, heretofore considered worthless, become of economical value.

Methods of obtaining Water Supply, for Sugar Plantations in the Hawaiian Islands.

By J. N. S. Williams, Puuene, Maui.

What is now known as the Territory of Hawaii, United States of America, consists of a group of Islands lying in the Pacific ocean 2,100 miles S. W. from San Francisco in Longtitude 155° to 161° W. and between the 18th. and 22nd. parallels of N. Latitude, just within the Tropic of Cancer and in the path of the Northerly trade winds.

The principal Islands of the group are Kauai, Oahu, Molokai, Maui and Hawaii, also some small and unimportant islands near by.

Geologically this group of Islands is peculiar and is supposed to be in connection with a long chain of islands stretching from North West to South East for some thousands of miles in the mid Pacific Ocean, the mountain tops of a submerged continent.

Each island in the group with the exception of Kauai consists of two mountain ranges of volcanic origin connected by an interval of comparatively flat and low land, these mountain ranges cross the path of the prevailing winds and form barriers to the clouds brought down which condense and precipitates a heavy rainfall on the mountain slopes on the windward sides of the various islands.

This heavy precipitation, amounting to upwards of 400 inches per annum in places, has caused great erosion of the steep mountain slopes, which, on the exposed sides are seamed with tremendous chasms some of them many hundreds of feet deep.

This process of erotion is still going on, and has had the practical effect of sweeping a great proportion of the surface soil of the windward coast down to the flats into the sea.

For this reason the best and most continuous stretches of lands are on the flats connecting the mountain ranges, and on the leeward sides of the islands. Since the rainfall on this side, while extremely heavy at times, is intermittent and due to a wind which seldom occurs, the land is not much cut up by gulches or canons nor yet has it been denuded of surface soil to such an extent as prevails on the windward side, and is much more fertile and productive.

These lands are composed partly of volcanic mud ejected from volcanoes (now extinct) and partly of decomposed lava resulting from ancient volcanic action and are covered by very scanty vegetation until water is brought out to them.

When the growing of sugar cane was first started on these islands some forty or fifty years ago, the plantings were made on the windward side of the islands to take advantage of the rainfall, and it was not until some years after the inception of the industry that it became evident that the rainfall was not regular enough, excepting in some few places, to produce the best results in cane culture ; and hence the first attempts at irrigation, accomplished by damming up streams and leading the water out by means of ditches to the head of the cultivated lands.

One successful ditch after another was put through and the sugar industry prospered greatly, giving incentive to works of colossal magnitude, consisting of miles of ditches and thousands of feet of inverted siphon pipes for carrying water across gulches which could not be bridged nor yet got around by flumes.

These siphon pipes are of sizes varying from 18 inches diameter to 48 inches in diameter and are made of rivetted wrought iron or steel plates of strength sufficient to carry static pressure due to heads of 500 feet and upwards.

These pipes are made in sections and riveted in place ; the fall given to the siphon pipe is usually one foot in one hundred feet of pipe measured on the curve, that is the bottom of the entry ditch will be one foot in one hundred feet of pipe higher than the bottom of the delivery ditch.

The size of the pipe is calculated so that the velocity of the water through it shall not exceed from 3-7 feet per second.

This fall in the pipe is more than is necessary to pass the water at the given speed but is allowed to compensate for the collection of mud, stones etc. in the bottom of the pipe and also for any growth that may form on the interior.

These pipes are always fitted with manholes and waste valves at the lowest points for the purposes of inspection and cleaning and are kept painted with an asphalt composition on the outside.

It sometimes becomes necessary to make close calculations on the delivery of water in iron inverted syphon pipes, and the following useful formula based on that of Trautwine has been successfully used in such instances.

Formula for finding the *total* head in feet that must be given to a rivetted steel or iron pipe of a given diameter, coated inside with asphaltum, to enable it to discharge a given required quantity : (Adapted from formula Art. 3, Page 248, 1885 edition, Trautwines' Civil Engineers Pocket Book)

Let H = total head or difference in level between the bottom of entry and delivery ditches serving an inverted siphon pipe.
D = required discharge in cubic feet per second.
L = length of pipe in feet measured on the curve.
d = diameter of pipe in feet.
c = Constant = for asphalted rivetted pipe 3496.

$$H = \frac{D^2 \times [L + (d \times 54)]}{c \times d\ (d^2 \times .7854)^2}$$

The constant c, = 3495, is deduced from the results of observations made by Mr. H. C. Perry C. E. in charge of the ditches and pipe lines on the sugar estate belonging to the Hawaiian Sugar Co. of Makaweli, Island of Kauai.

These pipe lines are 40 inches diameter inside the small end of the courses of pipe and deliver 55 cubic feet of water per second measured over a weir situated in the delivery ditch.

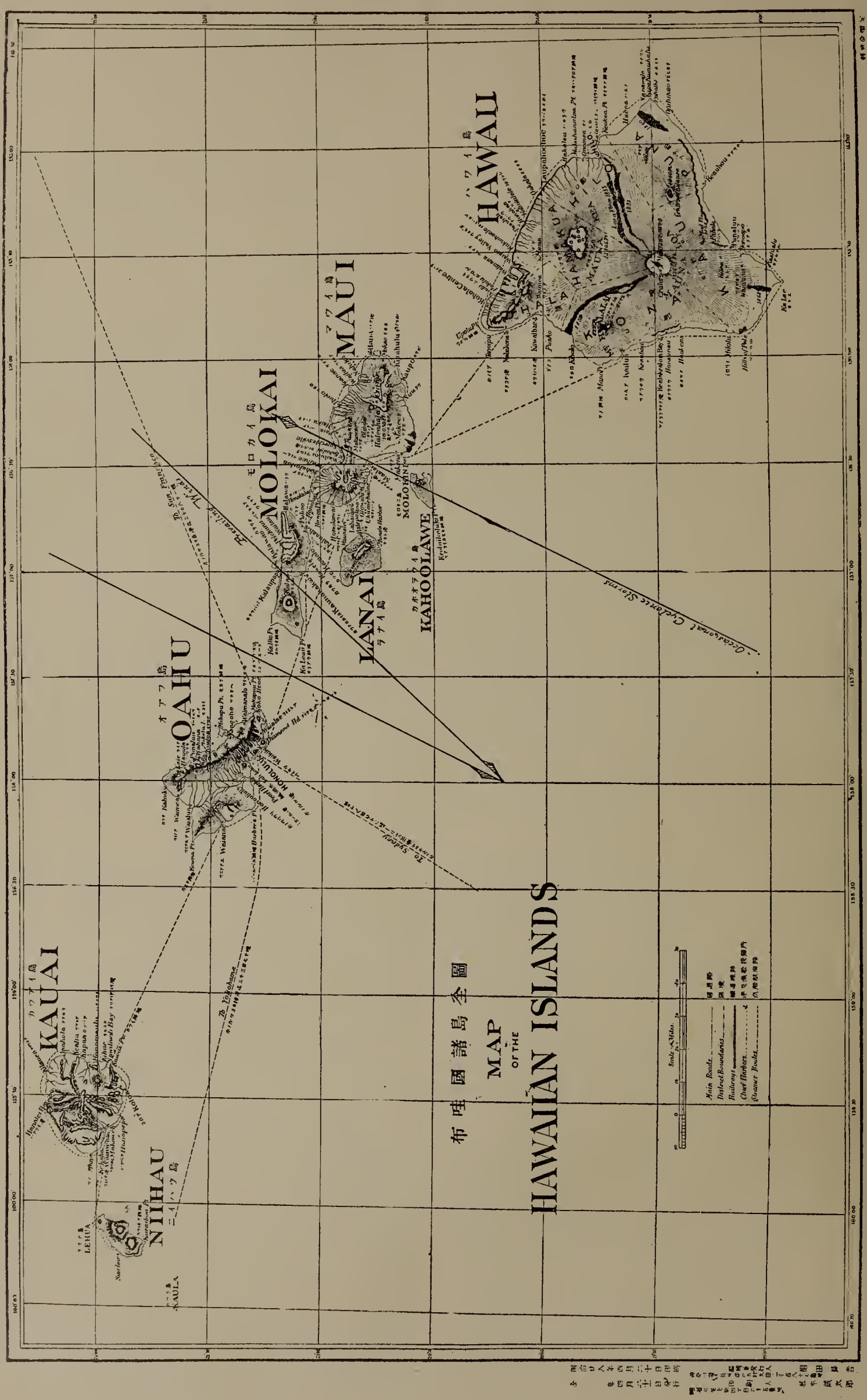
In all siphon pipes used in this country the radius of curve is so great that the pipe can be taken as straight without appreciable error.

The formula gives results which compare closely with observed discharges in several pipe lines varying from 20″ to 48″ diameter and from 500 to 2,500 feet in length.

No observed data are available for pipes longer than about 1000 diameters.

Of late, tunnelling as a means of conveying water in a country very much cut up by gulches has been successfully adopted, particularly in districts where the canons are very deep and close together. The tunnels are driven on a grade and follow the general course of the canons keeping some little distance back from the face of the bluffs ; break throughs are driven from the tunnels to the face of the bluff as a means of ventilation, for the discharge of rock and for the purpose of catching small streams which fall

* Paper presented at the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.


HAWAII
MAUI
MOLOKAI
KAHOOLAWE
LANAI
OAHU
KAUAI
NIIHAU
HAWAIIAN ISLANDS
MAP
OF THE
布哇國諸島全圖
Main Roads
District Boundaries
Railways
Chief Harbors
Steamer Routes
Scale of Miles

HAWAIIAN SUGAR PLANTATION.

FIG. 1.

FIG. 2.

FIG. 3.

down the face of the cliffs especially near the heads of the gulches, —see sketch of cross section of tunnel herewith.

A special instance of this work is shown in the Olokele Ditch just completed for the Hawaiian Sugar Company above mentioned ; and in the Nahiku Ditch for the Hawaiian Commercial and Sugar Company of Maui, Hawaiian Islands, now under construction, both of which ditches with all work connected therewith are under the supervision of M. M. O'Shaughnessy, Esq., C.E.*

Where the tunnels pass through seamy rock the bottom and sides are lined with cement mortar 1 part cement to 4 parts of sand, in ordinary rock the mud brought down by the water in freshets will in a short time tighten the tunnel bottom so that no leakage will occur.

The ditches are given a grade of 1 foot in 1,000, sometimes a little more depending upon the scouring action of the water on the ditch bottoms.

As regards the construction of the ditches and flumes where used, the ordinary practice is followed, special care being taken at the entries to siphon pipes to fit substantial and large waste gates, so that in event of heavy local rainstorms the excess of water shall escape away from the head works of the pipe line.

In general work on a sugar plantation that uses irrigation, the quantity of water required to properly irrigate 100 acres of land under cane cultivation is one million gallons per 24 hours, and as large plantations have from 7,000 to 12,000 acres of land in cane, from 70 to 120 millions of gallons of water per 24 hours is required.

Some plantations are situated in districts where no surface water is available, others again cannot obtain a sufficient supply from their ditches and catchment areas, so to supply their needs, sinking for water has been resorted to.

On the Island of Oahu an underground reservoir of water which could be tapped by artesian wells was discovered some years ago ; this water rises at this place some 30 feet above the level of the sea and is found at depths varying from 400 to 1,200 feet.

Pumping machinery of great capacity was put down and the underground supply drawn upon for use on the plantations situated within the artesian area.

At the present time the daily water pumped from artesian wells on the Island of Oahu reaches about 300 millions of gallons, some of it lifted upwards of 500 feet in height.

This condition of an artesian supply does not appear to exist on any of the other islands in the group, and when pumping is resorted to, open wells or sumps are excavated, the underground supply resulting from rainfall on the mountain sides percolating through an upper broken stratum and retained by the lower stratum of impervious rock.

These sumps are excavated to about 20 feet below sea level, tunnels are then driven on the lower stratum directly inland, opening up the water bearing rocks and the supply thus obtained is pumped from the sumps through very long pipe lines to the levels required on the cultivated areas.

To avoid the heavy expense of long pipe lines, there are three instances of shaft sinking at the upper levels of the cultivated lands down to sea level and regular underground pump of mining pattern installed, but these have proved so expensive in first cost and upkeep that there is no encouragement to repeat the experiment.

One of the largest stations of this kind is at Kihei on the Island of Maui where the shaft is 300 feet deep and two pumping engines of a combined capacity of 17 million gallons of water per day lifted 400 feet high are situated in a very large chamber excavated in the rock ; an abundant water supply is found at sea level ; but the expenses of operation are very heavy in comparison to those of surface pumping stations delivering water through long pipe lines.

The machinery installed in the various pumping stations is of the most modern and complete make obtainable at the present day, and as in no other part of the world are such mechanical irrigating plants in existence, a more than passing notice may be of interest.

The plantations that pump all or part of their irrigation supply are situated as follows :

Island of Kauai,	3,	approx. delivery	24 hours,	in gallons	75 millions.
Island of Oahu,	6,	"	"	"	360 "
Island of Maui,	5,	"	"	"	150 "
Island of Hawaii,	2,	"	"	"	10 "
Total delivery per 24 hours, gallons about					595 gallons

The average height to which this water is pumped is about 200 feet and the total power developed to deliver this enormous quantity of water is over 20,000 horsepower.

The stations are divided into units of various capacities situated at spots most convenient for obtaining the water. The largest units deliver from 10 to 12 millions of gallons per 24 hours and a station may have as many as four units ; the majority have only one.

The pumps themselves can be divided into three classes : Impeller pumps such as centrifugal or other types of rotary pumps ; Multivalve pumps such as the Worthington and others in which piston or plunger pumps draw and discharge water through large numbers of small valves set in suitable suction and discharge chambers ; which valves open and close by the water pressure : and pumps having mechanically operated suction and discharge valves of which only one type, the "Riedler" Patent constructed by the Allis Chalmers Company of Chicago, has been operated in this country.

The pumping stations are fitted with all kinds of boilers of which two makes stand first in point of numbers installed—Babcock and Wilcox Water tube boiler and the Sederholm Fire tube boiler, and there are all kinds of fuel and labor saving arrangements. Green economizers in the flues, arrangements for coal handling, automatic damper regulators etc. etc. And as a result exceedingly high efficiencies are obtained in ordinary work.

The engines driving the pumping machinery are almost all of the Corliss type two cylinder compound, three cylinder triple expansion, and four cylinder triple expansion of the very best make and finish, and fitted with all modern appliances in the shape of condensers, feed water heaters, and in one instance the latest ideas in superheated steam have been applied.

The mechanical efficiencies obtained on the various systems of pumps are as follows :

Centrifugal pumps delivering to 50 feet head, from 45%–55%

Impeller or Rotary Pumps from 60%–75%

Multivalve pumps, from 75%–85% and mechanically operated valve pumps from 85%–90%.

In one mechanical efficiency test made by the author on a Reidler triple expansion pumping engine, delivering water at 375 feet above the level of the water in the sump, at the rate of 10

* The author is informed by the Hon. H. P. Baldwin that this method of conveying water was first adopted in this country when the Hamakua Ditch Co's line on the Island of Maui was constructed some 25 years ago, since then this very bold scheme has been improved upon to such an extent that in the above mentioned ditches no siphon pipes or flumes, (which are liable to distruction by cloud bursts or violent rainstorms) have been used, and a arge proportion of the entire ditch line is tunnel.

million gallons per 24 hours, and the water delivered by pump measured over a wier especially made for the purpose, the remarkable figure of 91.85% was obtained; that is, of the horse power developed on the main engines 91.85% was expended in doing useful work on the water delivered.

This test was undertaken for the purpose of determining the slip or back lash of the water in a pump having mechanically operated suction and discharge valves, which in this instance was found to be ¼ of 1%.

The necessity of high economy in pumping machinery in this country is seen when the cost of coal at from $7.00 to $9.00 per ton delivered into the furnace is considered.

A large number of pumping stations are now operated with California crude oil as fuel, which is furnished to the various stations at $1.50 per barrel of 42 gallons; at this price oil is about equal in value to coal at $6.00 per ton, but as oil leaves no residues nor yet soots up the tubes or economizers as coal does, the economy in labor by using oil instead of coal is very marked. In a large pumping plant formerly employing eight firemen and coal passers per day, and two water tenders, the eight men have been cut out entirely, the work of keeping steam with fuel oil being done, and done easily, by the two water tenders in addition to their other duties.

It, however, is clear that such an economy is obtainable only in large plants, as in small plants operated by one man on a watch, no economy in labor is possible.

The burners used for crude oil are of various kinds and makes, but the results obtained by each are about the same, 6 pounds of ordinary crude oil of 18 Beaumé (mimus scale) being equal to 10 pounds of ordinary coal.

When the use of oil was first contemplated it was expected that the boilers would suffer from the intense heat generated in the furnaces, but this expectation was not justified, as all experience here goes to show that the life of a boiler will be just as long with oil as with coal for fuel, provided that the proper furnace arrangements are adopted.

By the courtesy of the Allis Chalmers Co. the writer is enabled to present plans showing a typical four cylinder triple expansion Reidler pumping engine and a Sederholm boiler fitted with automatic stokers etc., also a photograph showing a three cylinder triple expansion pumping plant of ten million gallons capacity as erected and in working order on the Oahu Sugar Co's and Hawaiian Commercial Co's plantations.

By the courtesy of the Hon. H. P. Baldwin, General Manager of the Hawaiian Commercial and Sugar Co., the writer is enabled to give the following figures for the cost of pumping water to different elevations by the following machinery:

Pump plungers	11 7/8"	diameter x 42"	stroke.
Steam Cylinders, H. P.	19"	" x 42"	"
I. P.	33"	" x 42"	"
L. P.	50"	" x 42"	"

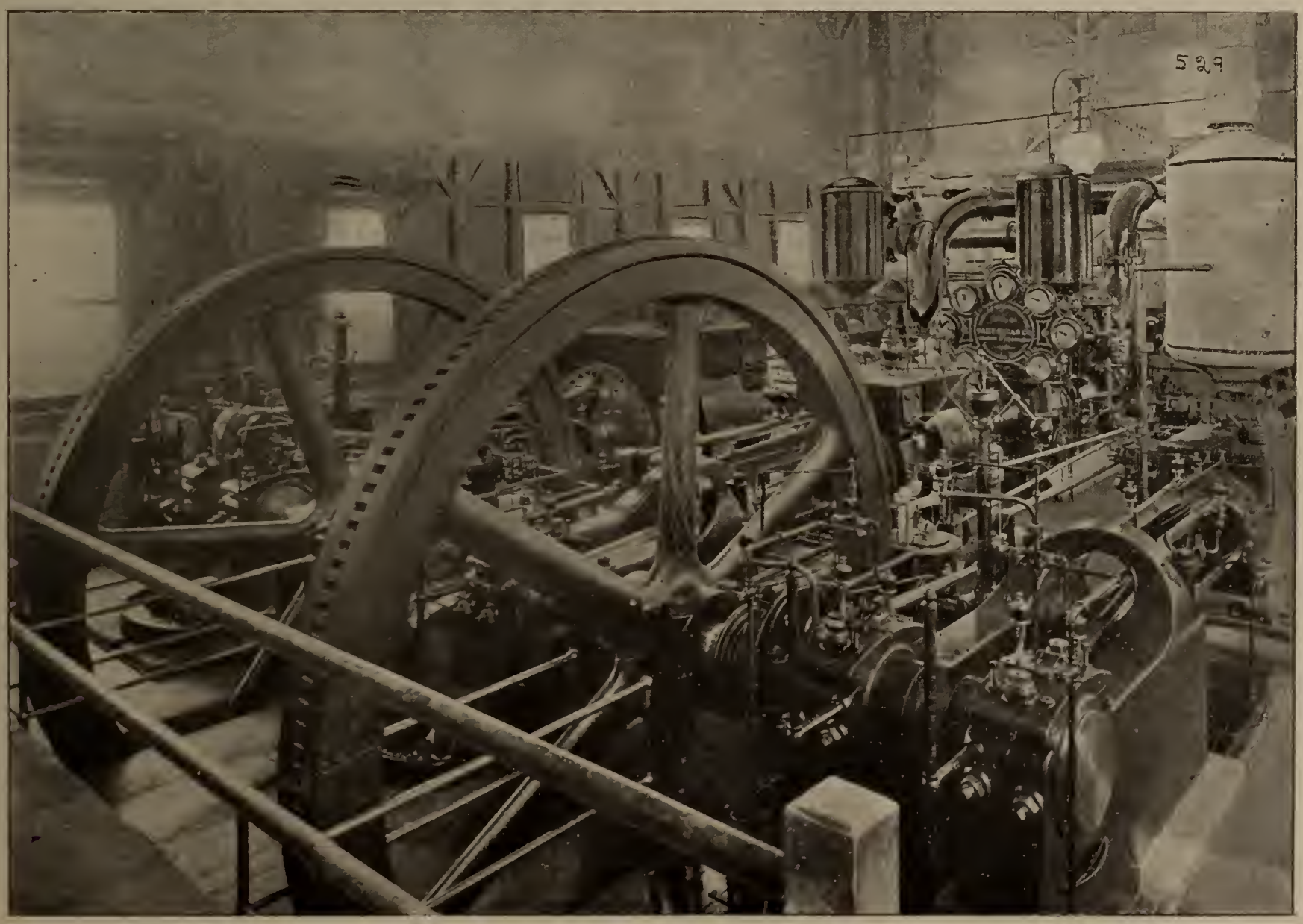
The whole forming a Reidler Triple Expansion Pumping Plant.

Sederholm Boilers, Green Economizers, California Crude oil for fuel, Steam pressure 180 lbs. above atmospheric pressure.

Revelutions of Engine per minute 54.

Delivery in 24 hours at this speed 9 million gallons.

Elevation of delivery.	Cost of million gallons.
100 feet	$ 7.85
200 "	11.57
225 "	12.50
250 "	13.44
300 "	15 30
350 "	17.17



which figures include superintendence, labor, fuel, supplies and repairs during one year which contained 240 pumping days. The figures would be considerably modified if continuous pumping were employed, but as occasional rain storms occur, the pumps are only operated when required.

The economy of such a pumping plant is high ; one horse-power being produced for the consumption of 1.12 lbs. of oil per hour, which at the rating of 6 lbs. of oil being equal to 10 lbs. of coal in ordinary work is equivalent to 1.87 lbs. of ordinary coal per horse power per hour.

As a rule pumping is considered to cost 50% more than ditching, but since the ditch depends on rainfall for its supply there is an element of uncertainty about it. Pumping on the other hand is very sure, since the underground supply of water is practically inexhaustible, and even during severe draughts when the ditches are nearly empty, the pumps are always able to furnish water.

The most conservative practice in irrigation works for sugar plantations where possible is to have both systems so that whichever way the barometer goes water is available for the crops in the ground.

LONDON LETTER.

LONDON, April, 1904.

Mining Markets here continue distinctly hard in tone with a tendency to increased business. But for the coyness of the public we should, no doubt, have brisk markets, seeing that the financial position is sound and prices generally cannot be far off bedrock. The elimination of the Whitaker Wright regime will also have its effect in due course and tend to render mining investments more in fashion.

British Columbians.—There has been a better market than for some time past. The Premier Mines (Le Roi No. 1 and Le Roi No. 2) are showing up very well and if the recent favorable developments hold good there are decidedly better prices ahead. Le Roi No. 1 on February results is earning a 50 p.c. dividend on its to-day's price of 28 p.c.

All Canadians will be glad to see the Le Roi properties having a fair chance, as they are now free of financial embarrassment and well equipped with working capital.

Australians are a very steady market with a rising tendency. The policy of centralization of control is having a remarkable effect in preventing share rigging. Nearly all the important mines are now in the hands of Bewick, Moreing & Co., with the result that working expenses are considerably reduced and every individual mine has the benefit of its neighbors' experience.

The Associated Northern Block squabble is now over and the real business of mining is in hand again. These shares round about the par price of £1 are not too high, as the mine possesses potentialities.

Great Fingalls and Golden Horseshoes are also solid investment. In fact a very promising " trust " could be made in this market.

South Africans.—The Kaffir circus is now in a very interesting situation. With the labor question practically solved, the bull account reduced to very modest dimensions, easy money, and prices at the lowest for the past four years, the market is in a position to respond promptly to a good lead. The last few days have shown increasing business of an investment character, and the undertone is very firm indeed. Stocks are in good hands and there are no keen sellers at present prices. On the whole this market has not looked so promising for a long time.

It is hoped that the better time coming will not be of quite such a mad character as in 1895, but that there will be steadily rising markets with good business all the way up. The Land Companies and Deep Levels are excellent purchases without almost an exception. As soon as the magnates are quite ready the market will go right ahead.

West Africans.—This much maligned market is not dead by any means and the shares of the Premier Mine (the Wassau) having fallen from £8 down to 30/- or so, have now turned the corner and are showing a much steadier front at about £2. Amalgamateds are also buyers.

Miscellaneous.—The big Wai-hi is going strong and the shares are being bought by insiders. Of course at £5 for the £1 share the future is rather discounted, but the shares are talked to £7 or £8. It is certainly an immense proposition and in capable hands, with enough ore in sight to last a decade.

Rio Tintos are buoyant on the past year's results and present strength of copper.

Taken all round the mining markets are well worth close attention.

PERSONALS.

Dr. Eugene Haanel, Superintendent of Mines, Mr. T. Cote, Mr. N. Strom and Mr. C E. Brown, electrician, of the Canadian Commission appointed to investigate the matter of the electric smelting of iron and steel, returned to Ottawa on the 16th of April.

Professor E. Rutherford, F.R.S., of McGill University, gave a lecture on Radium before the McGill Graduates of the Ottawa Valley, in Ottawa on the 19th instant.

Mr. J. Obalski, Inspector of Mines, for the Province of Quebec, was in Ottawa during the month.

Mr. Eugene Coste, E.M., Toronto, was in Ottawa on the 15th instant, and removed the furniture and papers of the late Secretary of the Mining Institute, to Toronto.

Mr. W. S. Lecky has just completed a tour of three months throughout Canada, from coast to coast as representative of Messrs. Lyman Sons & Co., of Montreal. This house which is well known for its supply of chemists and assayers material intend to give to Canadian chemists and assayers a first class service and a very large stock from which to select ; a new catalogue will be issued for circulation this summer.

Mr. Ervin Dryer has resigned his position in connection with the Westinghouse Electric & Manufacturing Co., and has accepted an appointment with the Allis-Chalmers Co. Mr. Dryer's connection with the Westinghouse Company extended over a period of sixteen years, and his wide acquaintance throughout the western part of the United States will be of great service to the Allis-Chalmers Company in the extensive new developments which they have undertaken.

Nova Scotia Gold.

A recent number of the *Canadian Gazette*, (London, Eng.) publishes what purports to be a cable despatch from Ottawa to an English paper, which says :—

" Official reports received here from Halifax state that very rich discoveries of gold have been made in Northern (?) Nova Scotia. Prospectors have been searching for the metal for a long time, but have only just found it in paying quantities. The new fields, according to the descriptions received here, are regarded at present as being comparable in richness to the Yukon and Australian mines."

The *Gazette* goes on to say that the discoveries of rich ore at depths of 950 feet in the Caribou District are due to the action of the Nova Scotia Government in granting aid to the sinking of shafts to a depth of 2,000 feet. Since the Act to encourage and aid deep gold mining in Nova Scotia only became law in March of this year it is difficult to believe that the deep shaft of the Baltimore and Nova Scotia Company is 'owed to the recent action of the Nova Scotia Legislature." Our good friend, Mr. L. W Getchell, Manager of the B. & N. S. Co., began and has prosecuted his mining work without regard to Government aid which, as a matter of fact, has not yet been availed of by any one.

The *Industrial Advocate* of Halifax, in commenting on this absurd presumption, says :—

" It is a pity that such inaccurate statements should obtain currrency in a journal identified with large Canadian interests in London. The impression conveyed by the message of the Ottawa correspondent is equally erroneous, as it gives the uninformed reader the idea that the discovery of gold in this province is a matter of recent occurrence, whereas the fact is gold has been successfully mined in Nova Scotia for forty years. The gold measures of the province extend from Yarmouth in the west to Guysborough in the east, a distance of nearly 400 miles, with a width from 25 to 75 miles. The geologists have held the opinion for years that the formation was analagous to that of the Bendigo-Australian mines, and the attainment of vertical depths of 900 feet by several companies proves the correctness of the above theory, the ore being found in a regular series of superimposed saddles, showing as good values in depth as at the surface. This important development has influenced the local government to engage to defray half the cost of sinking one or more perpendicular shafts 2,000 feet to demonstrate the permanency of the gold measures of this province."

The perseverance and intellectual acumen of Mr. E. R. Faribault, C.E., of the Dominion Geological Survey, has enabled him to correctly work out the formation of the saddle veins in Nova Scotia, and to his work more than to any other cause is due the renewed interest in the possibilities of deep mining in the Nova Scotia gold fields. That such deep mining will be remunerative, and that Nova Scotia gold mines will add to their reputation within the next decade, cannot be doubted by any one who is familiar with the industry in that Province.

Eastern Canadians have not been much interested in that strong organizntion known as the Western Federation of Mining, but our countrymen in British Columbia (especially Rossland) have known that same organization somewhat intimately. Western subscribers therefore may find it interesting to know that the martial law which ruled at Telluride, Colorado, and which was occasioned by the lawlessness (even to murder) of certnin strikers and agitators, was ended about the middle of March, and that the guarding of the town and mining properties has again been left to the citizens. Agitators were deported from the towns affected and warned not to return, and as a rule they have heeded the warning. While there may be, and probably is, no connection between the offenders and the Western Federation of miners, yet the influence and effect of the disturbance has been detrimental to the Federation, inasmuch as the Union miners in Cripple Creek are disaffected and have left the ranks of the Federation which is thus crippled in what, hitherto, has been its greatest stronghold in the Western States.

The Ogilvie Gold Dredging Company.

The annual meeting of this company was held in Ottawa on the 29th. of March. The President, Mr. Wm. Ogilvie, presented the report of the Directors for the last year, which (briefly) stated that during the season of 1903 the management had devoted their efforts to the prospecting of about seven miles out of the 110 owned by the Company. Some rich deposits had been located, but their extent had not been accurately determined. The Board was, however, satisfied that during the coming season sufficient ground would be tested and located to permit of keeping a large dredge at work on profitable ground; the President added that he was assured, personally, of a satisfactory future for the Company, and moved the adoption of the Report.

In the discussion ensuing several shareholders expressed their dissatisfaction with the Report and the Management; there were no details presented in the Report, nor any statement of receipts and expenditures. Mr. McIsaac, M.P. for Antigonish, N. S., voiced the sentiments of some Eastern shareholders, and expressed dissatisfaction with the results obtained. He claimed that a return of only $1300 in gold for a whole season's work with a dredging capacity of 1000 yards per day, showed incompetency somewhere; more gold should have been saved; the delay in waiting for repair parts to the machinery could have been avoided if the management had been good.

Mr. Arthur Ross, of Montreal, was dissatisfied with the information afforded to shareholders, he would like to have seen a detailed account of receipts and expenditures submitted, and moved that a printed statement of the accounts be prepared and sent to shareholders; this was agreed to.

The President, Mr. Ogilvie, in reply said that the object of last season's work was exploratory and not intended to be remunerative, the Board had wished to do this work before purchasing a large dredge to work the ground commercially. He stated that the machinery delays had been unavoidable because of failure to deliver on the part of the firm furnishing the machinery. Any such delay could be avoided for the future. The report was then adopted.

Mr. N. J. Kerr made a motion that the dredge be worekd the coming season as a gold saver, and not as a prospecting machine; this motion was seconded by Mr. Thos. Birkett, M.P., and carried.

The election for directors resulted in the following as the Board for the coming year:—Mr. Wm. Ogilvie. Wm. Gamble, R. R. Samuel, Thos. Birkett, W. Morley Ogilvie, N. J. Kerr, and H. P. Godard.

The Montreal and Boston Copper Company.

A meeting of this corporation was held in Montreal on Wednesday, the 20th of April, at which the shareholders voted in favor of a resolution merging the Montreal and Boston Copper Co., The Dominion Copper Co., Ltd., The Morrison Mines, Ltd., The Athelstan and Jack Pot Gold Mining Co., Ltd. and three-fourths of the Emma Mine into a new corporation, to be called The Montreal and Boston Consolidated Mining and Smelting Co.

The new corporation is to have a capitalization of $7,500,000, of which $1,000,000 is to remain in the Treasury, $1,500,000 to be issued to the Montreal and Boston Copper Co. (at the rate of one share of new stock for two shares of old), and $5,000,000 to a Syndicate which agrees to turn in therefor the whole of the capital stock of the other three companies mentioned, together with three-fourths of the Emma Mine. The Knickerbocker Trust Co. of New York City has agreed to act as Trustee to receive and exchange the old shares for the new ones.

The programme of the new corporation is to erect a fourth blast furnace, and a converter with a daily capacity of 1500 tons, at Boundary Falls. It is also announced that the new coporation intends to secure a coal property and erect its own coking ovens, so that the operation of the furnaces will be independent of the labor troubles which the Crows Nest Pass Co. have had to contend with. The possibility of the Montreal and Boston Consolidated Company having labor troubles of its own does not seem to have been considered.

MINING NOTES

NOVA SCOTIA.

The Londonderry Iron & Mining Company has now one of its two stacks in operation, turning out foundry pig; the second stack will not be remodelled at present. The bulk of the output is used by the Eastern branch of the Montreal Pipe Foundry Company, whose new plant at Londonderry has just been completed.

The old workings of the Londonderry mine have been cleaned up so far as possible, and a considerable quantity of good ore recovered; the necessary ores for mixing are obtained from other iron mines in the Province. Mr. W. F. C. Parsons, the resident mining engineer of the Company, has also started new drives in promising ground, and appearances indicate that this property, which has been worked by different corporations for over fifty years, has yet a long and profitable life before it.

The Acadia Coal Company, Stellarton, N.S., are to instal an electric lighting plant for their offices, tipples, collieries, etc. The Westinghouse Company's machinery is specified and the contract for the machinery and installation has been let to John Starr, Son & Co., of Halifax.

Annapolis County has been pleasantly excited by the rumor that a combination of American and Canadian capital is to establish extensive iron works near Parrsboro, N. S. It is reported that this combination has secured control of the iron deposits near Torbrook, and contemplates the erection of blast furnaces, bloomaries and rail mills. Names of interested people, however, are not given and the report lacks confirmation.

Heyl and Patterson, the Pittsburg construction firm which contracted for the new coal washing plant of the Dominion Iron and Steel Company at Sydney, C. B., were put to considerable annoyance by a general strike of their workmen early in this month. When the firm took laborers to Sydney they were promised the same wages as obtained with the employees of the Iron and Steel Company for similar work, viz: from $1.50 to $1.60 per day for the concrete men and $2.50 per day for carpenters. On beginning work it was found that the Steel Co. was not paying as high wages as the contractors had supposed, hence the strike. The Italians were the first to quit work to the number of over 100, and they threatened violence to the other laborers should they resume work. The carpenters, numbering about 75, then went out on a claim for 25c. an hour, but returned the same day for 22½c. per hour. The laborers' strike has since been adjusted.

QUEBEC.

Bell's Asbestos Co. had a better year in 1903 than in 1902, and declared a 4 per cent. dividend. The balance carried forward is over £10,000, of which £7,000 is put to Reserve Account, and £2,555 is divided amongst the Directors; of of this £2,555, £2,000 is appropriated to the Managing Director by way of salary. The shareholders are dissatisfied with the division of profits.

NORTH-WEST TERRITORIES.

Mr. Hugh Sutherland, of Winnipeg, has obtained the control of what are reported to be very extensive beds of gypsum, situated in Northern Manitoba.

BRITISH COLUMBIA.

The *Atlin Claim* reports a strike of ore in a quartz vein 8 feet wide which assays 13 ozs. 14 dwts. of gold to the ton. The strike is on Boulder Mountain.

The Golden Copper Mining Company has been incorporated under British Columbia laws, with a capital of $200,000, to carry on the business of mining and smelting ores of that metal.

Southern East Kootenay, from present information, is to have a gold boom this year. Reports claim that two old river beds of Triassic gravel have been discovered, which carry high values in gold.

It is reported from Vancouver that a gentleman largely interested in Coast properties has devised a new process for the recovery of values from sulphide ores, and has erected an experimental plant with a capacity of 25 tons per diem.

The Pacific Coast Steamship Company has chartered two vessels, the J. B. Thomas and the St. James, to carry coal from Ladysmith, on Vancouver Island, to Nome, Alaska; the intention is to carry from 15,000 to 20,000 tons during the season.

It is reported from Banff that the Canadian Pacific Railway Company has promise of a valuable bed of anthracite in or near the Park limits which, in size and quality, surpasses the exhausted seam at Anthracite. The preliminary opening of the deposit is being made by a cross-cut tunnel.

Arrangements are making to purchase the property of the former Dundee Gold Mining Company, Limited, in Ymir District, from the Bank which now holds possession. The proposals contemplate the formation of a new company with a nominal capital of $500,000. The amount of value exposed in the workings is put at $120,000 gross.

News of a new rich placer field was received in Vancouver early in the month of April. The find is reported to be at the head of the Nahaani river, a branch of the Liard river, in latitude (approximately) 61° north, and longitude 126° west. The distance from Fort Wrangel is approximately 450 miles.

Western papers report that the British Columbia Copper Company, Limited, is to resume the exploitation of the deeper levels on that property during the coming summer. For nearly three years the Company has confined its attention to the extraction of ore from its surface quarries, from which some 300,000 tons have been shipped.

The Granby Smelting Company is interested in the International Coal Company of Crow's Nest Pass, Alberta, and as the latter company are now building coke ovens it is presumed that the smelter people will supply their works with the coke made by the International Company.

At the present time it is reported that the Butte Smelters are taking 300 tons a day of coke from the Crow's Nest Coal Co., and that the latter company are seeking a market for an additional 600 tons per day, which they claim are available. It is well known that the output of the C.N.P.C. company's coke ovens is now far beyond any possible demand of the Kootenay smelters.

Shipments of ore from the Rossland Camp to the smelters dropped in the middle of April to 3,000 tons from the usual amount of 9,000 tons weekly. The stoppage of the Le Roi owing to the shut-down at the Northport smelter to which it ships, and the interference with the traffic by the sudden melting of the heavy snows on the mountains account for the big drop in shipments.

During the month of February, 1904, ten carloads of ore were shipped from the Arlington Mine, Erie, containing 229 tons, the net smelter returns from which amounted to $10.453.69. The expenses in British Columbia for the month amounted to $3,639.23, leaving a profit on the month's working of $6,814.46.

The Consolidated Cariboo Hydraulic Mining Company has been much hampered and delayed for several seasons by lack of water, although its fine system of reservoirs and ditches is very extensive. The Company therefore will undertake this season to dam another lake and make its waters tributary to the old system by the construction of another ditch some 15 miles in length. The construction cost of obtaining this additional supply is estimated at $250,000.

The sales of zinc ore made by the Payne Mining Company have demonstrated the importance of the zinc ores of the Slocan District. The experience of the St. Eugene, Ivanhoe and other mines in shipments made to Antwerp, and to Iola, Kansas, form a solid basis for a permanent industry which will not only add to the yearly wealth coming from British Columbia mines, but will also aid in solving economic problems for the silver-lead companies.

On the 13th of April the agent for the Dominion Government, (Mr. G. O. Buchanan,) paid over to the nine owners the first bonuses payable under the Lead Bounty Act. The mines receiving cheques were : the Sovereign, Highland, Whitewater, Enterprise, Sullivan, Rambler-Cariboo, Black Prince, Wilcox, Silver Cup, Bluebird, Red Fox, Neepawa, Mercury, Idaho-Alamo, Ymir, Payne, North Star, Province, Bosun, Pontiac and Marion.

There are the usual rumors this year of proposed new smelting works in different parts of the Province. During the last five years there has been a distinct advance in the number of smelters in active operation, as witness the stack at Crofton, and the one at Ladysmith on Vancouver Island, which are in constant operation and which derive their ores entirely from Coast mines ; some copper ore has also been shipped down from White Horse, but the future of the smelting ores from the Yukon depends almost entirely upon the transportation problem.

Early in this month the Payne mine at Sandon, B.C., reported a strike from No. 8 tunnel. A drive on the vein broke into about two feet of galena, showing a large sprinkling of ruby silver and grey copper. Picked samples assayed 840 ozs. of silver to the ton. This is good news to shareholders, some of whom believed that the days of rich ore were over. It is most important as showing that the Slocan ore bodies do not lose their high values with depth, (the former average value of the Payne ore ran about 100 ozs. of silver,) and should induce owners and corporations to prosecute deep level work.

Reports from the Iowa-Lillocet Dredging Company are very glowing. The new dredge installed by the Hamilton Manufacturing Company took out an average of 40 oz. of gold per shift of ten hours, for a period of twelve days. This dredge is operating on a lease of the Fraser River, at Lillooet ; the gravel has been prospected in places to a depth of 40 feet, and it is predicted that the results from the dredge will average $1,000 per day. As a result a boom in gold dredges for this section is predicted. The old dredge at Lytton has been repaired and is now at work, and reports are circulated that it is earning good pay.

The Western Fuel Company are constructing large coal bunkers, modern wharves, etc., at Northfield Point, Vancouver Island. A new shaft has been started to cut and open the 7 foot seam recently found in the Northfield slope ; this shaft will be used exclusively for hoisting coal, the miners using the slope as heretofore for ingress and egress. The plant which has been brought out is one of the finest in the West. The company is also settling a townsite of its own, just north of the colliery, which will have the name of "Brechen." Cottages are to be brought in from Northfield and provision made for a settlement of 500 people.

Irresponsible talk credits the C.P.R. with the intention of building a branch line from Spence's Bridge, B.C. to Nicola Lake, for the double purpose of serving the rich Nicola Valley and of opening up the coal fields lying near the Lake. It is now some three years since the REVIEW had special knowledge of these coal fields, which are certainly large and contain several seams of high grade coal. The point, however, is made that British Columbia at present has a far larger supply of excellent coal than there is sufficient market for, and that the C.P.R., being a business corporation, is not likely to expend money on new branches until there is assurance of a steady paying traffic on such branches.

The Nickel Plate Mine in the Similkameen district is also reported as a probable builder of a smelter. It is reported that Mr. M. K. Rodgers, the Manager of the Nickel Plate, has been endeavoring to secure a site for the works in the vicinity of the mine and that the only site available is on a portion of the Indian Reserve. The efforts to secure this site by negotiating with the Dominion Government and the Indians have resulted in the Indians agreeing to surrender for an equivalent reservation elsewhere in the valley atd the offer of 100 acres by the Government to Mr. Rogers for a smelter site, but this is not satisfactory to Mr. Rogers, and he now announces that if he builds a smelter he will build it in United States just south of the boundary line.

Early in April there was some little newspaper talk over the possibility of building a smelter on Valdez Island in the gulf of Georgia, due probably to the visit of Mr. A. J. Jordan of Seattle. These rumors are probably due to the fact that there are a large number of prospects and producing properties at various points along the coast of British Columbia north of Vancouver. Some of these properties are already shippers in a small way, their product going to Crofton, Tacoma, and Everett. They have a large factor in their favor since most of them are within reach of tidewater thus permitting of cheap transportation for the ore. It is predicted, and with reason, that these properties would work on a very much larger scale if there were abundant facilities for the purchaser and cheap smelting of their ores.

Rumors have it that the somewhat notorious Britannia Copper Mine on Howe Sound is to be resuscitated and actively developed. A new organization known as the "Howe Sound Mining Company," has been organised with a capital of $2,000,000, and which has absorbed all of the original shares of the old Britannia Company ; one half of the capital or $1,000,000 in paper was paid for the Britannia and $500,000 of the remaining stock has been taken at 50% at par, so it is reported, by the new interests. Messrs. G. H. Robinson of Salt Lake, Jas. Bellinger of Spokane, Stevens of New York City, are said to be the United States representatives, Mr Frank Leonard continues as Manager of the property. It is proposed to begin work at once by the erection of a wharf and ore bunkers and to proceed with the construction of a concentration plant ; the ore will probably be sent to the Crofton smelter.

YUKON.

Spring has come early on the Klondike, the 26th. of March being reported as very warm.

To facilitate service to the new Alsek gold diggings during the present season, the White Pass and Yukon Navigation Company will operate a steamship service between the town of White Horse on the Yukon, and Mendenhall Landing on the Takhena river, this being the best route to the new gold fields.

The Canadian Pacific Railway announces that, beginning on the 15th of June, two daily trains will be run between Montreal and Vancouver, instead of one train as heretofore. This doubled service is necessitated by the very large increase in travel to the Western Provinces.

Reports from Hunker, Dominion and Sulphur Creeks are to the effect that the past season has been one of the most successful these creeks have ever had, and that if the supply of water holds, the cleanups will be record ones. Dominion has taben out more wash dirt than any other creek, and promises the largest return. Most of the work on Dominion has been on the twelve claims immediately below No. 1. Most of the work on Hunker has been from 40 to 50 below discovery. The results from the working of the dredge put on Bonanza Creek have been most satisfactory. The difficulties previously encountered have been overcome, and report says that two new large dredges are to be put, this season, on Forty-Mile.

A man who has recently returned from the Alsek district reports that over 2000 claims have been recorded and that the Government has promised some money for the building of trails. Wages in the district are reported to be $5 per day and board, or $8 per day without board. It is also stated that once a person gets into the district it is difficult to get out again as there is not an abundance of employment for labor. Men tempted by tales of big pay in this northern country should take heed to the warning that the chances of getting work in these new districts are slim.

INDUSTRIAL NOTES.

The A Leschen & Sons Rope Co. have issued a very useful form of advertising in the shape of a celluloid rope guage, which calipers rope from 1¼" diameter down to ¼" diameter. Anyone using or handling wire rope will find this guage most convenient, and the A. Leschen Co. offers to furnish it to any and all who use wire rope. This firm is increasing its sales rapidly, and its customers report uniform satisfaction.

The well known advertising agency of Franklin P. Shumway has been incorporated as the "Franklin P. Shumway Co ," under the laws of Massachusetts, with a capital of $30,000. The offices of the corporation are situated at 373 Washington St., Boston, Mass., and are well equipped for handling both American and European advertising. Newspaper publishers who have had the satisfaction of dealing with Mr. Shumway will wish the new corporation every success.

Our esteemed and always instructive contemporary—*Mines and Minerals* has devoted the greater portion of its April issue to a collection of authoritative articles on the subject of wire ropes. Each of these articles is written by an authority, in admirably clear style and language, each is copiously illustrated, and the issue is even worthy of a permanent binding and a place on the shelves of every mining engineer, mine operator and mechanical engineer.

Mines and Minerals is one of the most valuable exchanges coming to our desk ; its pages are full of original, timely and valuable matter, presented in a clean faced type on good paper. We have found the reading of its pages to be accompanied with less eye fatigue than almost any other sheet meeting the editorial eye.

The Allis-Chalmers Co. have organised a Department of Publicity, of which Mr. Arthur Warran is the Manager. This step has been necessitated by the extension of the business into so many fields. The firm has long been favorably known for its mining, rock crushing, milling and blowing machinery, and for its perseverence as Engine Builders ; it is now in the field for Gas Engines, Steam Turbines, and both electric and hydraulic machinery.

The Leschen & Sons Rope Co. of St. Louis, have just issued a neat little pamphlet on the Transportation of Ores by Aerial Rope Tramways. This firm have the distinction of having built and equipped the largest wire rope tramway in North America, via : that of the North American Copper Co. at Encampment, Wyoming, which has the length of 16 miles. An unusual point in this Tramway is that, although some sections have very steep gradients, no section has sufficient fall to permit of operation by force of gravity, hence, engines have had to be used to operate the system. The tramway has a capacity of 400 tons in 10 hours, with a longest span of 2,300 feet.

The tramway is of the double rope type, having a stationery track cable and an endless traction rope for propelling the buckets. The latter are attached to the traction rope by a patented clip. The sheaves used on the towers over which the ropes pass have their flanges and grooves so arranged as to accommodate the clip on the traction rope, so that the rope always rests on the sheave groove whether a bucket is passing over a tower or not. This is essentially different from most other wire rope systems, as the enormous strain to which the rope is subjected in systems where the traction rope is carried under the saddles, are not encountered.

The various novelties are well worth the investigation of any engineer proposing a new installation for a mine.

There are newer features in the bucket clip, which is moulded to the lay of the rope thereby avoiding both slipping and abrasion ; and also in the pendants from which the buckets are hung. The grip wheels take hold of the rope from the outside, and (it is claimed) do not injure the rope.

The Ottumwa Box Car Loader has come into such general use in the United States that it is attracting the attention of coal operators in Canada. There are already several of these loaders in use in Canada, one having been in operation at the Canadian Pacific Railway Company's docks at Fort William, Ontario, for nearly a year. The Lake Erie Coal Co. is installing one of these loaders at their Walkerville, Ontario, dock. The Acadia Coal Co. of Stellarton, Nova Scotia, and the Intercolonial Coal Mining Co. of Westville, have each one machine. There is hardly a coal mining district in the United States that does not use these loaders which are made by the Ottumwa Box Car Loader Co., of Ottumwa, Iowa, U.S.A., whose advertisement appears in this issue. Coal operators in Canada should investigate this labor saving device.

The American Forged Steel Flange Company, Chicago, Ill., are putting in the market a new departure from anything of this kind that has heretofore been available. The flanges are made from a high grade soft steel which permits of punching and rivetting with a power rivetter without fear of leaking.

Nova Scotia Steel and Coal Co., Ltd.—The Company has in course of erection at Sydney Mines, the following additions to their plant :—

A Blast Furnace with a capacity of 250 tons per day.

30 Bauer Coke Ovens and 120 Bernard Ovens ; 4 open hearth Basic furnaces.

The Blast furnace is nearly completed and will probobly go into blast in July.

They have also opened up at Sydney Mines two new collieries known as Sydney No. 2 and Sydney No. 3, and it is expected that the output for the three collieries for the year 1904, will be about 600,000 tons.

NEW COMPANIES.

BRITISH COLUMBIA.

"The Ferguson Mines, Limited," "Non-Personal Liability"—Incorporated under the Statutes of British Columbia, 14th March, 1904. Authorized capital, one million four hundred thousand dollars, in one million four hundred thousand shares of one dollar each. Formed to acquire the properties known as "The Ferguson Mines, Limised."

"Spokane Falls Placer Mining Company, Limited," "Non-Personal Liability."—Registered as an Extra-Provincial Company, 21st March, 1904. Authorized capital, two hundred and fifty thousand dollars, divided into two hundred and fifty thousand shares of one dollar each. Head Office: Spokane, Washington U. S. A. Canadian Office: Trout Lake City, B. C., G. W. Carothers, Trout Lake City, B C. Attorney. Formed to acquire the properties known as the "Spokane Falls Placer Mining Company, Limited."

Rose Gulch Hydraulic Mining Company, Limited.—Incorporated under the statutes of British Columbia, 26th March, 1904. Authorized capital, fifty thousand dollars, divided into one thousand shares of fifty dollars each. Formed to acquire the properties known as the "Rose Hydraulic Mining Company, Limited."

Imperial Coal and Coke Company Limited.—Licensed to carry on business in the province of British Columbia, 5th April, 1904. Authorized capital $4,500,000 in shares of $100,00 each. Head Office: Montreal, Que. Head Office in British Columbia, James Harvey, Barrister, Cranbrooke, B. C.

Slough Creek, Limited.—Licensed to carry on business in the province of British Columbia, 15th March, 1904 Authorized capital £200,000 in shares of £1 each. Head Office in Canada : John Hopp, Mining Engineer, Stanley, B. C.

The Imperial Coal and Coke Co. Limited.

This Corporation has been formed under Dominion laws to work an exceedingly large area of coal land which is situated on the west slope of the Rocky Mountains some seven or eight miles north of the town of Michel, in the Crow's Nest Pass region. Our company notes show the capital to be registered as $4,500,000 in shares of $100 each. An option on the control of the stock has been given to Montreal men who have organised with Mr. W. Herbert Evans as President and Mr. Humes Hall as the Secretary ; the company's Head Offices at present are located in the Canada Life Building, Montreal The property, which embraces something over 60,000 acres, is at present held under License but if the promotion is successful Crown Grants will be issued upon payment of $5 an acre to the British Columbia Government. The property was acquired by Mr. Andrew Laidlaw and Mr. John Brown, Jr., of Spokane, Wash., twelve months ago, which gentlemen bought out all the locators, and transferred the title to the New Imperial Coal Company.

From present information the Company has a season of prospecting ahead of it as no developments have been made upon the property ; a force of men will be put at work as soon as the snow is off the ground and openings will be made at such points as may seem most favorable for permanent workings No estimates of tonnage can be reliably made at present but on the assumption of continuous coal beds the aggregate tonnage contained in the 95 sq. miles would be very large. It is reported that there are ten seams of workable widths outcropping on the property and that these ten seams aggregate 110 ft. in thickness ; the outcrops are reported to be visible over a north and south running extent of 25 miles. Large payments will have to be made by the Montrealers on their options during the coming summer in order to make good their title.

The Great Western Mill, Lardeau District.

This mill is being constructed near Ferguson in the Lardeau District, and is expected to start in a few weeks at the latest. It has been constructed to treat the gold and silver ores of the Nettie L, and the Silver Cup mines, and also such custom ore as may offer. It has twenty stamps of the ordinary type with a crushing capacity of about 50 tons daily. It is built on the side hill plan so that all handling is done by gravity ; there are five floors in the mill. The fourth and fifth floors are occupied by ore bins and the terminals of two tram-lines of the Riblet system ; the third floor has a Blake rock breaker run by an electric motor, below are the batteries. On the fourth floor are four Dodds buddles for the treatment of galena ores and two Frue vanners for the treatment of heavy iron sulphides ; the concentrates, whether lead or iron, are to be shipped to smelters for treatment.

The first floor, which is the lowest is devoted to the treatment of zinc blend, containing dryers, and two Bruckner cylinders in which the zinc concentrates are roasted with salt forming a chloride of zinc which is volatile, the baser metals remaining in the roasted product. The roasted product is then worked in amalgamating pans by a modification of the old Washoe system and treated with quick-silver and ground. The pulp is then discharged into agitators and afterwards into settlers for the collection of amalgam, and the stream from the settlers is passed through a gold amalgamator (patent type) to save such portion of the free gold values as may have escaped the preceding appliances. The mill is driven by two three-foot Pelton water wheels, each with a double nozzle, working under a head of 150 ft. of water. These wheels actuate two Westinghouse alternating current dynamos which furnish the power and light for the plant.

The April Issue of the *Crop Reporter*, which is published under the authority of the United States Secretary of Agriculture, has an article clearly showing and recognizing the agricultural importance of the Canadian Northwest. The rapid advance in the yield of the most important cereals is emphasized by the quotation of statistics, *e.g.* In 1898 the total yield of Spring wheat was 5,717,149 bushels, in 1903 the yield was 16,534,308 bushels, a yield of 300% in six years ; the yield of oats in 1898 was 3,136,122 bushels, in 1903 it was 14,626,578, nearly five times the crop of 1898 ; the yield of barley in 1898 was 463,678 bushels. in 1903 it was 1,706,083, an advance of almost four fold. The principal crops of the Northwest in 1898 totalled about 9,000,000 bushels, whereas in 1903 they totalled about 35,000,000 bushels. The significance of these figures is not the fertility of the land which is shown thereby, but the demonstration they afford that a region which has, for years, been supposed to be barren on account of its *severe climate*, has such a *good* climate that cereals flourish and are profitable. Canada can have no better advertisement of its climate and fertility than the publication of these figures.

CANADIAN MINING INSTITUTE

Incorporated by Act of Parliament 1898

AIMS AND OBJECTS.

(A) To promote the Arts and Sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications.

(B) The establishment of a central reference library and a headquarters for the purpose of this organisation.

(C) To take concerted action upon such matters as effect the mining and metallurgical industries of the Dominion of Canada.

(D) To encourage and promote these industries by all lawful and honourable means.

MEMBERSHIP.

MEMBERS shall be persons engaged in the direction and operation of mines and metallurgical works mining engineers, geologists, metallurgists, or chemists, and such other persons as the Council may see fit to elect.

STUDENT MEMBERS shall include persons who are qualifying themselves for the profession of mining or metallurgical engineering, students in pure and applied science in any technical school in the Dominion, and such other persons, up to the age of 25 years, who shall be engaged as apprentices or assistants in mining, metallurgical or geological work, or who may desire to participate in the benefits of the meetings, library and publications of the Institute. Student Members shall be eligible for election as Members after the age of 25 years.

SUBSCRIPTION.

Members yearly subscription.....$10 00
Student Members do 2 00

PUBLICATIONS.

Vol. I, 1898, 66 pp., out of print.
Vol. II, 1899, 285 pp., bound red cloth.
Vol. III, 1900, 270 pp., " "
Vol. IV, 1901, 333 pp., " "
Vol. V, 1902, 700 pp., " "
Vol. VI, 1903, 600 pp., now in press.

Membership in the Canadian Mining Institute is open to everyone interested in promoting the profession and industry of mining without qualification or restrictions.

Forms of application for membership, and copies of the Journal of the Institute, etc., may be obtained upon application to

THE SECRETARY,
Orme's Hall, Ottawa

Dominion of Canada

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be aquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7 50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee, $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be obtained within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one half per cent on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200.

A certificate that work has been done must be obtained each year: if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior,
OTTAWA, February, 1904.

JAMES A. SMART,
Deputy of the Minister of the Interior.

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel. graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental - such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

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Ontario's Mining Lands..

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite: copper in sulphide and native form; gold, mostly in free milling quartz; silver, native and sulphides; zincblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1900 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe. The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc, apply to

HONORABLE E. J. DAVIS,
Commissioner of Crown Lands,

or

THOS. W. GIBSON,
Director Bureau of Mines,
Toronto, Ontario.

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GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

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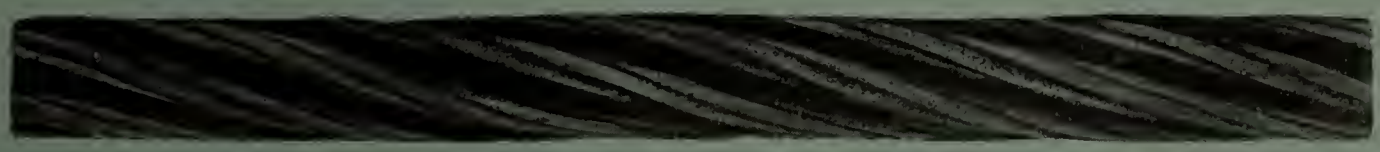

Illustration of ¾" diar. Special Improved Patent Steel Wire Rope, 1760 yards long, supplied to Dalzell Colliery, Motherwell, Scot., which ran two years and 8 months, shewing condition when taken off. Previous rope from another maker lasted 1 year and 9 months

TELEGRAMS—"Ropery Rutherglen. A B C, A I and Lieber's Codes used.

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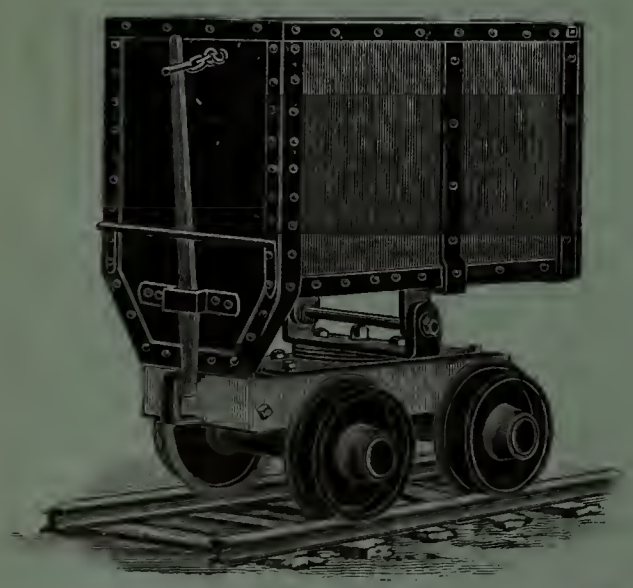

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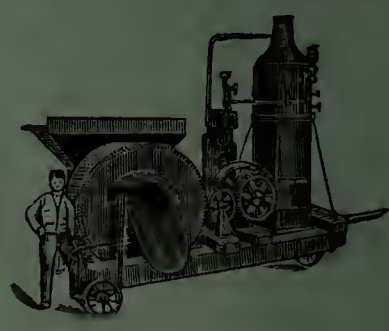

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Established 1882

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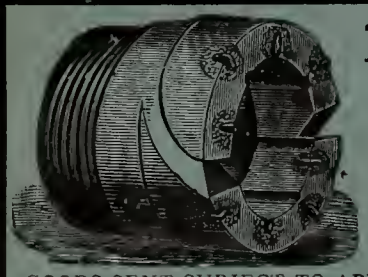

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The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P. Q.

Dominion of Canada

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be aquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7 50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee, $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be obtained within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one half per cent on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200.

A certificate that work has been done must be obtained each year: if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

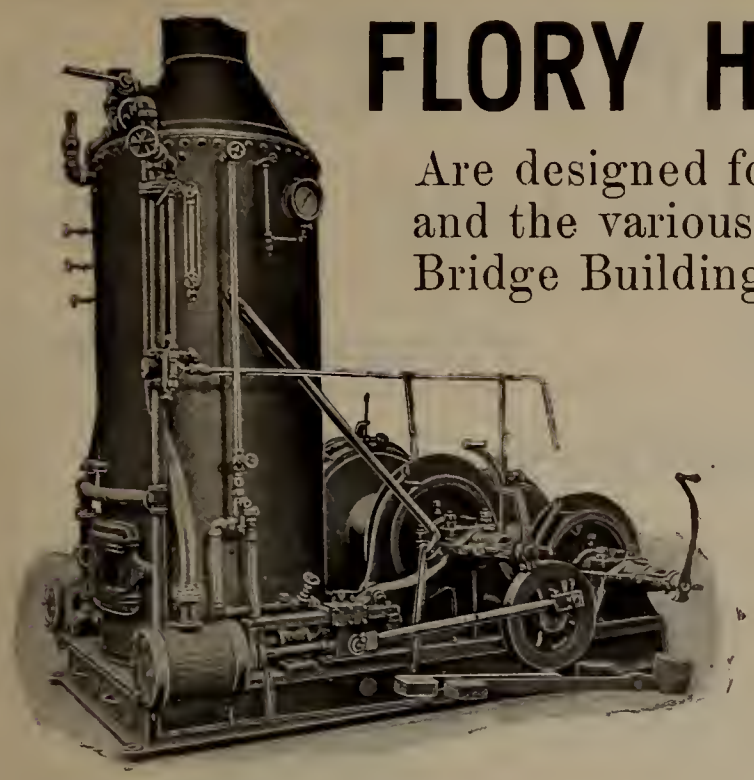
The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior,
OTTAWA, February, 1904.

JAMES A. SMART,
Deputy of the Minister of the Interior.



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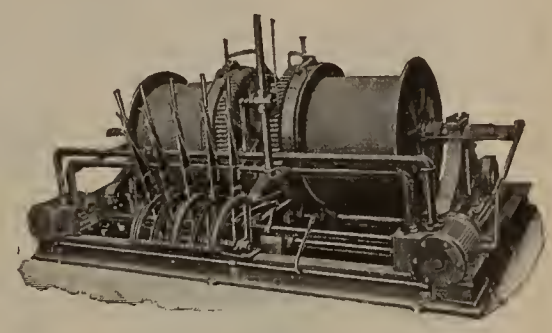

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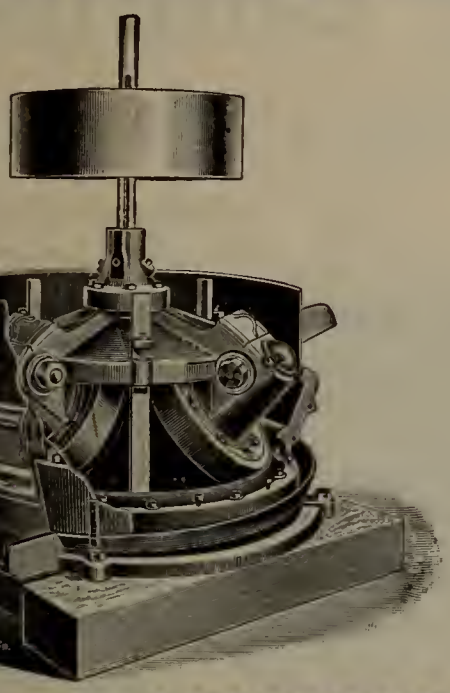

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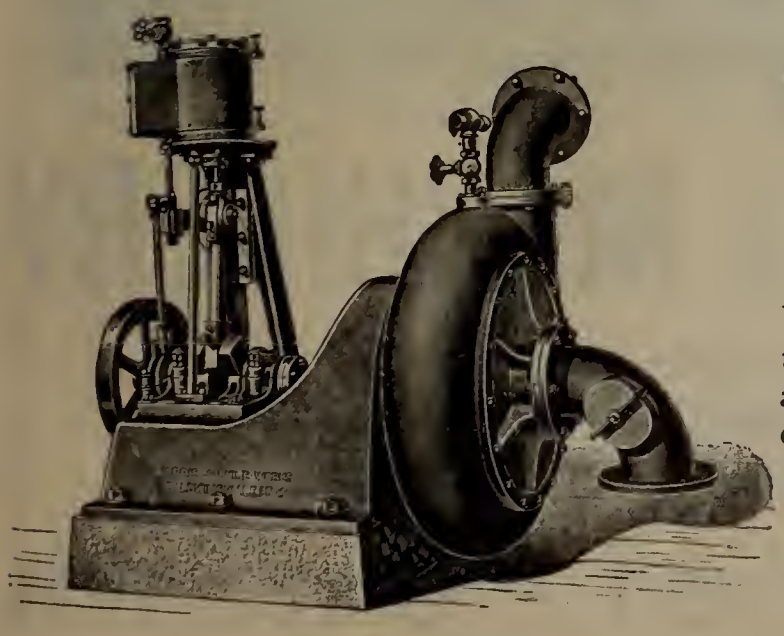

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22nd YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

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CONTENTS.

Our article on "British Columbia and the Lead Bounty," in our last issue has been made the subject of comment in a letter which we are requested not to publish, but as some of the statements in our article are called in question by this private communication we feel at liberty to make some editorial comments.

Our correspondent says that there has never been any discussion, *at any time*, of the question of what portion of the bounty on lead should be received by the smelters, and further, that "no smelter has ever received any share whatever of the bounty." Speaking exactly and literally the words we have quoted may make a correct statement, but indirectly, the smelters have been large participants in the bounty through the increased freight, smelting and *especially* marketing charges, which they have imposed upon the miner.

The editorial in question was based upon the facts obtained from one of the largest, if not the largest, corporation in British Columbia interested in the silver-lead question, and it was not the intention of the editorial to in any way revive or stimulate the old differences of opinion between the producers and the smelters. The facts as stated in our article are *true*, and are not contradicted by the various articles which have appeared in the press of Nelson, Kalso, Vancouver and Spokane, during the last two months. The members of the Mine Owners Association and the gentlemen representing the smelting industries of British Columbia will know whether our writer was correct or incorrect in his generalizations; that he was well informed by people personally interested, and thoroughly conversant with the subject, is what we assure to our readers.

Mining in Newfoundland.

The annual report of the Mineral Statistics of Newfoundland issued by the Director of the Geological Survey, Jas. P. Howley Esq., F.G.S., contains some of the data which is responsible for the largely increased interest now taken in the mineral resources of the island.

The most noteworthy change from previous years was in the large decrease of iron ore shipments from Bell Island. The deposits on this island are owned (as our readers know) by the Dominion Iron and Steel Company and by the Nova Scotia Steel and Coal Company. The output of ore by the Dominion Company was 59,885 tons less than in 1902, and the Nova Scotia Company decreased its shipments by 80,041 tons, making a total decrease for 1903 over 1902 of 133,072 tons.

The shipments of copper ore aggregated 87,790 tons, being an increase of 13,182 tons over 1902; by reason of the better price ruling for metallic copper the *value* of the shipments exceeded, by $117,474.00, the value obtained in 1902. The bulk of the production continues to come from the mines at Tilt Cove, leased to the Cape Copper Company in 1890 for a term of 99 years, which produced 75,676 tons.

The pyrites industry also showed a gratifying increase, coming from the deposit on Pilley's Island. This mine marketed 42,000 tons in 1903, against 26,000 tons in 1902. The Dominion Iron and Steel Co. still holds the option on the large deposit at Rowsell's Harbor, Labrador, and it is reported that 1904 will see some production from this deposit.

1903 was noteworthy in Newfoundland as witnessing the inception of a small but promising gold production. It appears that, in addition to the quartz deposits carrying free gold which have been formerly noticed, a placer, or gravel, deposit at White Bay, known as the "Sop Arm Mine" has made a production. The value reported as obtained is $3,000.00, but note is made in Mr. Howley's report that the treatment adopted has not succeeded in satisfactorily saving the gold; many of the finer particles being washed away and not recovered.

The auriferous lode mine at Cinq Cerf Brook is in a band of quartzite, intercalcated and mixed with slates of talcose or chloritic nature. It is highly mineralized with copper sulphides (bornite, erubescite and chalcopyrite) and carries its gold in particles which

sometimes are free in the quartzose rock, and sometimes are embedded in the metallic sulphides mentioned. The values in gold are low, the highest as yet being $7.00 per ton, but no fair or average test has yet been made.

The petroleum field at Parson's Pond has not been active; up to the first of the year six holes had been completed and two more partly drilled, the completed holes are producers but as no continuous pumping has been done the actual yield of these wells is yet indeterminate. From results obtained they are estimated at 5 bbls. each, per day.

The deposits of chrome iron ore at Benoit Brook remain as in 1902, undeveloped, and the talc deposits of Conception Bay are in the same condition.

The mineral industry employed 2067 persons in 1902, out of which number there were six deaths from accidents. The total *local* value of the *metallic ore* production was $1,144,845, which Mr. Howley points out is about one seventh of the *actual* value when converted into market products. The actual value, based on ruling market prices for the metals contained, is put by Mr. Howley at over $8,000,000, but we need not point out that such valuation is not permissable. To the members of the Canadian Mining Institute such an example of figuring values recalls the numerous papers and discussions on Mineral Statistics with which they are acquainted, and to the editor of the REVIEW it recalls the remarks of President Coste at the Toronto meeting of this year.

The value of a country's mineral production is what that production brings as it is used, or sold, in that country, and although the REVIEW sympathises with Mr. Howley's aim and methods in his endeavors to create metallurgical and chemical industries in Newfoundland to use the raw products which that island affords, it has to acknowledge that the Dominion of Canada is suffering, to a proportionate extent, in having a larger raw mineral production than it can manufacture. Newfoundland needs a portion of the same cure which is prescribed for Canada, viz.—a large increase of population. The statistics of ores produced are very creditable, and the report is a most valuable document for those interested in mineral productions.

Again the Le Roi Mine.

The mining portion of the British press seems to be again in a high state of excitement concerning the condition of the Le Roi mine. It appears that early in the present month the London Board received a telegram from the acting general manager, Mr. J. H. Mackenzie, reading as follows:—"Shipped from the mine to the Northport smelter during the month 3,720 tons of ore from all stopes which show the average value of the mine is $8.17 per ton; 430 tons shipped from 1,350 feet level showed $7.45 per ton. No profit at all has been made for several months. The amounts realised from the treatment of the furnace bottoms is $85,000. Owing to faulty sampling and assaying and excessive valuation, $335,000 has been made in the assets," and at the same time was advised by a cable from Mr. Anthony McMillan, the managing director, that he had not yet had time to investigaten, or to see Mr. Parrish who has been seriously ill.

Upon receipt of these telegrams the Board at once sent out copies, which administered a heavy blow to the mining shares on the market, the price tumbling from 1 5/16 on April 25th, to 7/8 on May 13th.

Since the new year began the reports emanating from the head office have been very satisfactory to shareholders because the monthly profits have been stated to be from £10,000, to £12,000; now the *acting* manager telegraphs that, owing to faulty sampling and assaying there has been an over valuation of some $335,000 or £67,000 stg. Such a telegram, if its news be verified, is indeed a cause of alarm, but the last annual report of this company, presented at the annual meeting held on the 18th February, 1904, told the shareholders over Mr. Parrish's signature, that while the average of the ore shipped during the fiscal year was $13.36 on which a net profit of $1.99 a ton was realized, yet the average value of the reserves at date of December 14th, 1903 was only $8.22 per ton. This is but 5 cents a ton different from the average value of the mine (viz.: $8.17) as given in Mr. Mackenzie's cablegram, and if shareholders had read Mr. Parrish's report they should not have been thrown "into a panic" by the recent cable news.

The position of the mine is no more serious than it was six months ago, and the REVIEW takes strong exception to the words used by the London B.C. *Review*, referring to Mr. Parrish, that "It is really inconceivable how a competent manager can have permitted this heavy loss to be incurred," etc., etc. "There has evidently been gross and culpable negligence on the part of the assaying staff for which the general management must be held responsible."

While the REVIEW is at one with the B.C. *Review* in contending that ore values have been over estimated in the past, and in being unable to take an optimistic view of the company or its property, yet it feels that the spirit of fair play will be manifested by the B.C. *Review* and that Mr. Parrish is not to be condemned for the failure of shareholders to read his report and imbibe his wisdom.

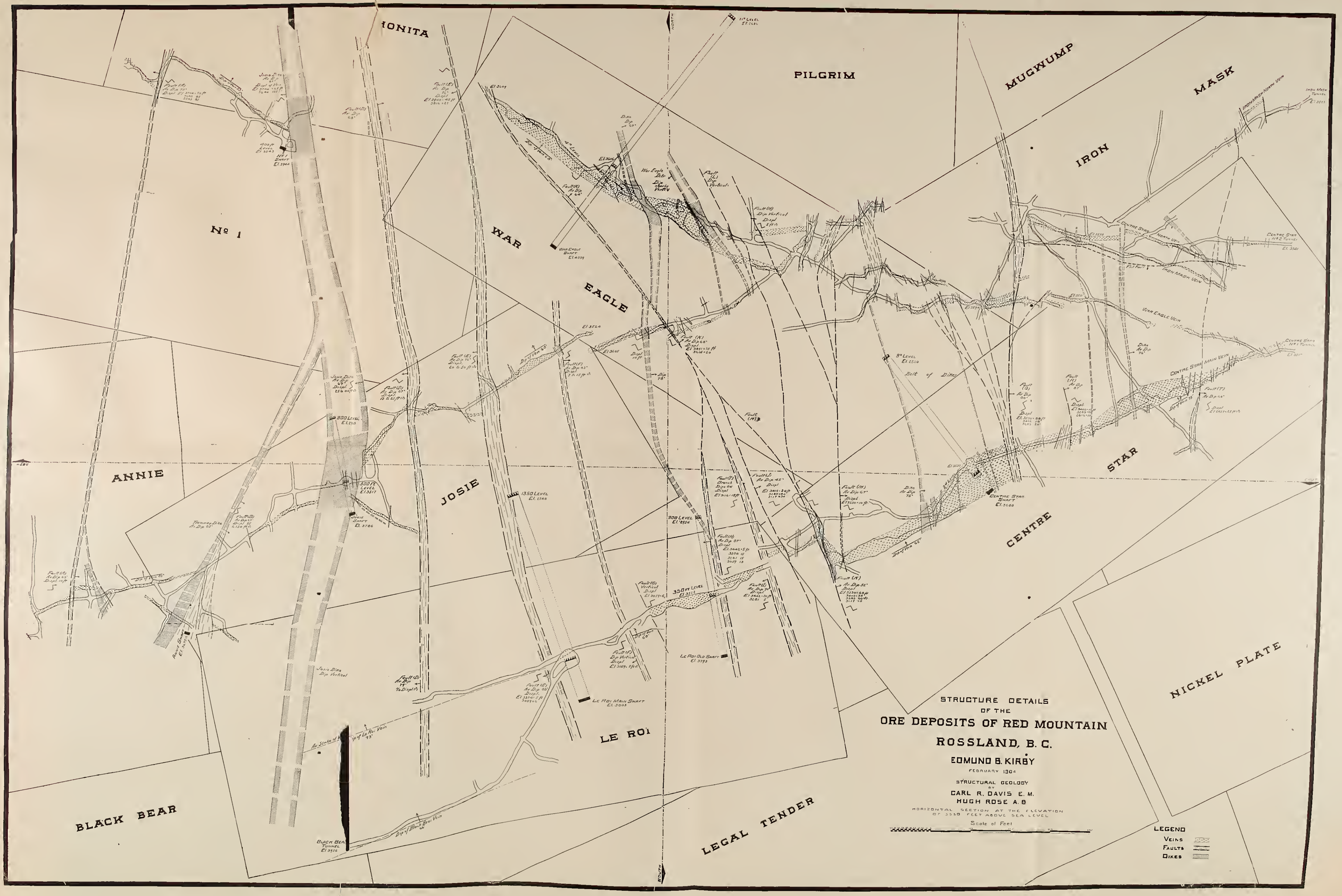
The REVIEW has never been optimistic about Rossland mines, at the same time it has realized the possibilities of the camp when it became possible to treat low grade ores at a profit. The point it desires its readers to note in connection with this flurry in Le Roi is that, no matter how competent, how able, nor how explicit in his reports a manager may be, his shareholders care nothing for what he writes unless it affects the share value of their holdings. Furthermore, in this case, the shareholders have been too blind or too lazy to read a competent manager's statement, and the result is not the fault of either the manager or the mine, but of their own limited capacity for absorbing knowledge.

Electrolytic Iron.

The article in the April issue of the REVIEW on the Electric Smelting of Iron Ores presented the existing concensus of opinion on the commercial question of smelting iron ores to a pig metal. Recent experiments in the laboratory of applied chemistry of the University of Wisconsin have shown that another application of electricity, viz; to the deposition electrically of a chemically pure iron, is not only feasible, but can be made at such a low cost as to make the application of wide commercial importance.

The process is the invention of C. F. Burgess and Carl Hambuechen who have communicated their results in a paper recently read before the American Electrochemical Society. Their researches have extended over a period of more than two years, and have been directed to the production of chemically pure iron in commercial quantities by an electrolytic process. Various electrolytes have been tried under varying physical conditions of heat, density, rapidity of deposition, and other working conditions, but the authors announce the following as the method which furnished the most satisfactory results:—

"The electrolyte consists of ferrous ammonium sulphates; the current density at the cathode is six to ten amperes per square foot of cathode surface, and at the anode slightly less; the electromotive force for each cell is slightly under one volt; the temperature of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CENTRE
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NICKEL PLATE
LE ROI
BLACK BEAR
LEGAL TENDER
STRUCTURE DETAILS
OF THE
ORE DEPOSITS OF RED MOUNTAIN
ROSSLAND, B. C.
EDMUND B. KIRBY
FEBRUARY 1904
STRUCTURAL GEOLOGY
BY
CARL R. DAVIS E. M.
HUGH ROSE A. B
HORIZONTAL SECTION AT THE ELEVATION
OF 3550 FEET ABOVE SEA LEVEL
Scale of Feet
LEGEND
VEINS
FAULTS
DIKES

700 Ft. LEVEL

LE ROI MINE

ELEVATION 3157 Ft.

EDMUND B. KIRBY

FEBRUARY 1904

Scale of Feet

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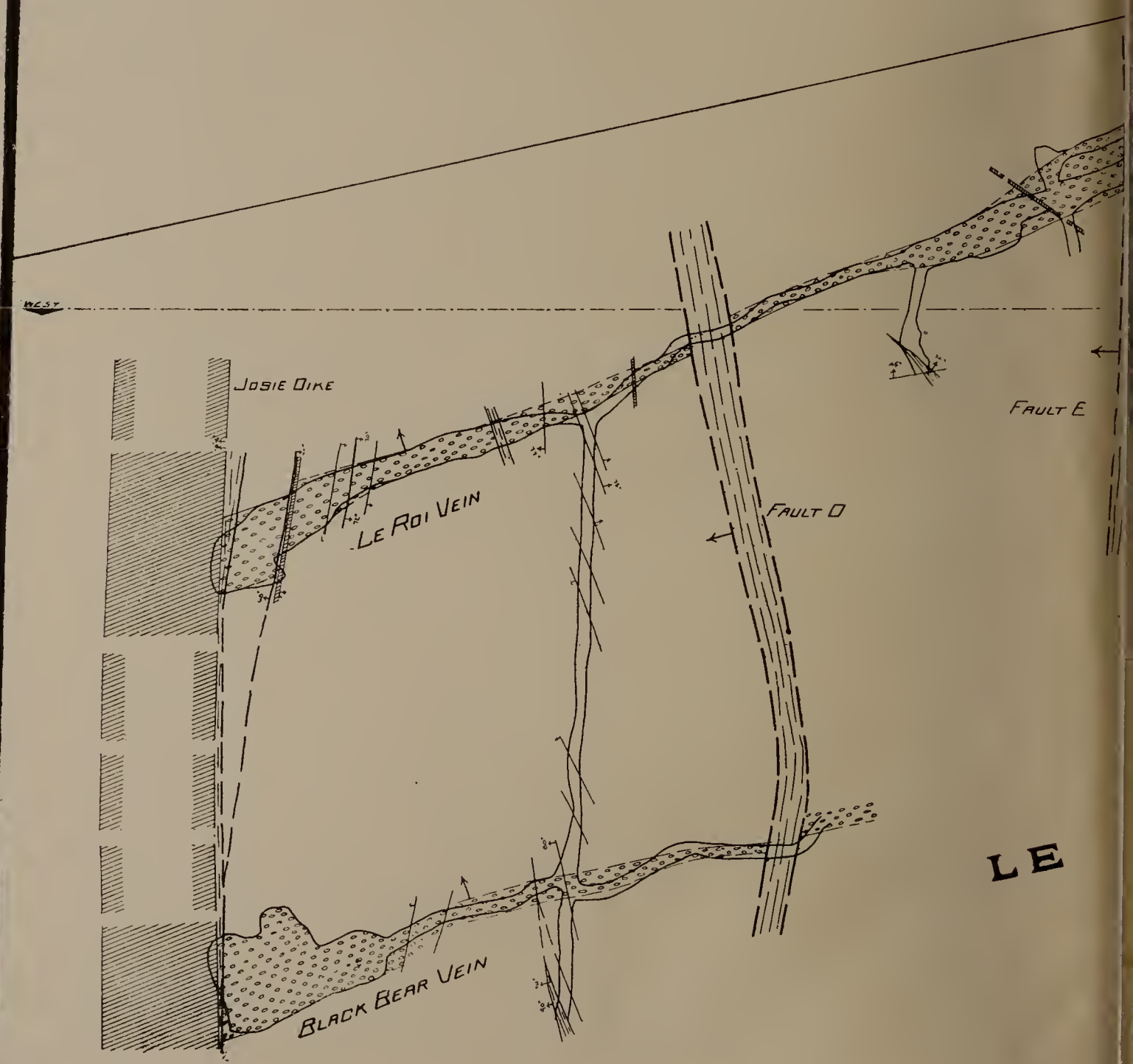

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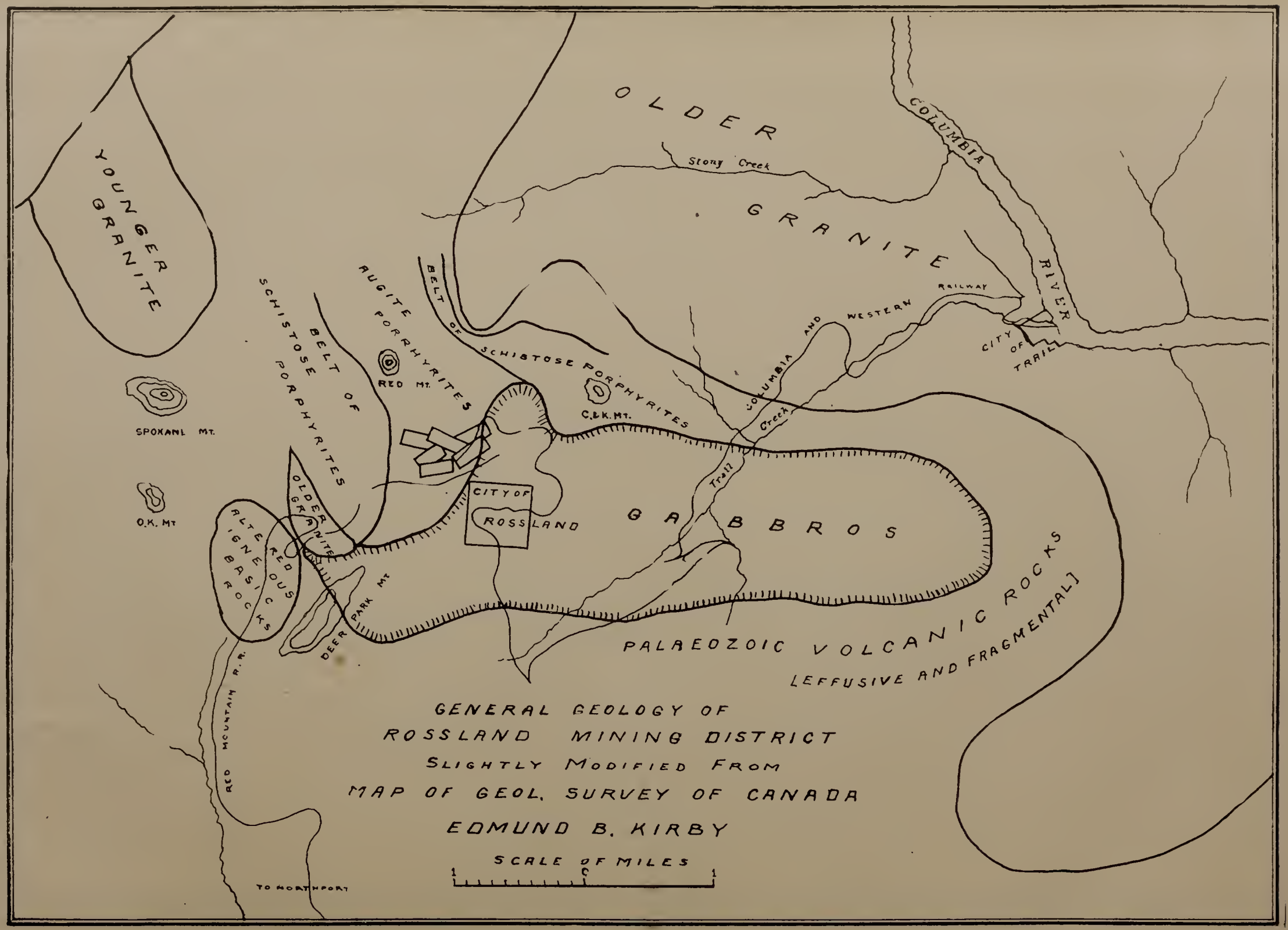


GENERAL GEOLOGY OF
ROSSLAND MINING DISTRICT
SLIGHTLY MODIFIED FROM
MAP OF GEOL. SURVEY OF CANADA
EDMUND B. KIRBY

SCALE OF MILES
1 0 1

PORTION OF SIXTH LEVEL
WAR EAGLE MINE

ELEVATION 3378 Ft.

EDMUND B. KIRBY

FEBRUARY 1904

Scale of Feet

NORTH

WEST

EAST

SOUTH

FAULT K

WAR EAGLE DIKE

FAULT L

LEGEND

VEINS

FAULTS

DIKES

electrolyte is about 30° C.; the anodes consist of ordinary grades of wrought iron and steel; the starting sheets for the cathodes are of thin sheet iron previously cleaned of rust and steel."

The analysis of the deposited metal shows over 99 9% of metallic iron with much occluded hydrogen, which has the effect of producing a hardness which the authors state is equivalent to a high carbon steel. This hydrogen is removable by heating, after which the metal becomes soft, malleable and tough, presenting the usual features of a high grade wrought iron.

The deposited metal is not only hard but very brittle, which may operate against its use in some applications which have been proposed. In fact the question as to what use can be made of such a metal, and what market obtained for it is what is of main interest to the iron world. That it will be of very great value and service in the chemical and metallographical laboratories is unquestioned, and the cheap cost of production, stated to be about $10.00 per ton of 2,000 lbs., will permit of a wide adoption when its field of use has been determined.

The Late Sir Clement Le Neve Foster.

Sir Clement Le Neve Foster, Professor of Mining at the Royal School of Mines, died in London on the 19th of April last. The deceased will be known by most mining men as the distinguished chief Inspector of Mines for Great Britain, in which capacity his reports were of great influence.

At the age of 19 Le Neve Foster began his practical work as assistant with Sir Roderick Murchison on the Geological Survey of Great Britain, being chiefly engaged in the counties of Kent and Sussex and afterwards in Derbyshire and Yorkshire. Resigning his position on the Survey staff he became lecturer to the Miners Association of Devon and Cornwall, and during this portion of his life interested himself greatly in the introduction into the mines of improved appliances and methods.

At the age of 27 years (in 1868) he resigned this appointment to undertake geological exploration in Sinai, and afterwards mining work in Central America, from which place he removed to Italy to engage in gold mining.

In 1872 he was first appointed to an Inspectorship of Mines, being stationed in the Devon and Cornwall districts for eight years, when he was transferred to North Wales. In 1894 he became chief Inspector, having the editing of the statistics relating to mines and quarries at the Home Office. He resigned his official position at the age of 50 and was knighted in 1903. Sir Clement was facile with his pen, and in addition to his well known books on "Ore and Stone Mining," and "Mining and Quarrying," he contributed to the Encyclopaedia Britannica the articles on mining in the seventh edition. In his death the world has lost an intelligent and courageous engineer.

A Correction of Mr. Kirby's Paper.

In the printing of Mr. E. B. Kirby's paper in our last issue there were one or two important errors which we desire to correct in this issue. On page 61 in the second column, 42nd line, the figure should be "$16.00 full assay value," instead of $15.00 and the table read thus :—

Gold (oz.)	0.63	0.54
Silver (oz.)	0.43	1.10
Copper (%)	1.18	1.88
Sulphide Minerals (%)	26.00	22.25

Page 62, line 28, insert "also" between "And" and "Centre Star." Pages 62 and 63 on the first column of each page, and in the 47th and 52nd lines respectively, the words "secondary" should read "subsequent" in each case. In the 28th line of the 2nd column, page 62, the following words should be inserted after the word "movements"—"and supplemented by branch fissures." In the 2nd column of page 63, 20th line, insert the word "mechanical" between the words "the" and "effect." On the 23rd line the word "segration" should read "segregation," and on the 34th line "excessive deposition" should be "successive deposition."

CORRESPONDENCE.

East Kootenay Coal and Oil Lands.

To The Editor.

Sir:—

For at least nine years East Kootenay has been the centre of attraction for all Canadians interested in the Coal lands of the West, and it has certainly maintained its reputation as a storm centre for politicians and speculators. The original discoverer of the Crow's Nest Pass coals could never have anticipated the notoriety which his modest discoveries have developed, and he would be a clever man who to day could predict when the storm-clouds would pass away and the era of intrigue and grab come to an end.

The acquisition of the first large area and its subsequent development is now a matter of history, and the successful promoters have settled down to "say nothing and saw wood." The scenes which accompanied the granting of the Crow's Nest Charter in 1895 and in 1896 are almost forgotten. To-day scarcely less excitement prevails at Victoria in connection with the disposition of blocks 4593 and 4594 which, for all practical purposes, are the last of the East Kootenay Coal and Oil Lands at the disposal of the Provincial Government.

At one time, and as a matter of fact three years ago, it was believed that the coal measures of the Pass were confined to the region extending from Lodge Pole Creek in the south to a few miles, say five, above Michel Creek in the north; and from the Elk River in the west to the boundary of the Province in the east. It was known from casual travellers over the trails that coal existed in the northern reaches of the Elk, as well as in the Flathead country. The late Dr. George M. Dawson had reported coal outcrops in the North Kootenay Pass but even so high an authority as the latter spoke with caution as to their quality and probable extent, and it was generally believed that the central basin, already defined, contained most if not all of the valuable coal deposits. Even without any extensive development it may at once be admitted that this conclusion was erroneous. Without going so far at present as to say that, as valuable an area has been located elsewhere, it is not too much to say that, on the North Elk, from the point where the coal measures are exposed again, after having been cut off by the limestone for a distance of 60 miles north, there is a coal-field from 8 to 10 miles in width which, on present prospecting shows a continuation of the same coal seams as at Fernie, and of a quality at the surface which gives reason to hope that at greater depth the quality will be practically the same. This immense coal-field covers 300,000 acres. It contains at least 20 known seams and a probable tonnage "in situ" of 30,000,000,000 tons capable of yielding in operation 50% or 15,000,000,000 tons.

In the Flathead valley to the south is also an immense coal-field, although it has not been so thoroughly prospected as the one in the north, and samples of the coal taken from the outcrops do not give anything like as favorable an analysis. Indeed, so far, more has been thought of the probability of this section becoming a great producer of oil than coal. In this however we entirely disagree with the representations so widely made by interested parties. We have made a

point of ascertaining all that can be definitely stated by competent authorities who have actually inspected the localities where evidence of natural oil is observable, and consider that it is quite premature to conclude that oil exists at any point in this section in paying quantities. The mere discovery of rocks and shales which on being pounded or scratched, yield an odor of petroleum or some kindred oil is poor evidence on which to base expectations of a flowing well. Nor is the presence of a film of petroleum floating on the surface of a pool of much higher value in the determination of "pay oil"; and yet this is the full extent of the evidence on which promoters are booming the "South Kootenay Oil Lands" and moving heaven and earth to secure large sums from investors in the shape of promotion money. The best advice we can procure is to the effect that the geological formation as well as the broken character of the strata throughout the whole of this country vetoes the possibility of oil in paying quantities, at any depth. This was the opinion of an eminent expert who examined the district three years ago for the Standard Oil Co., at a time when, if his Company had desired, they could have acquired the whole territory for a tithe of what is being asked now. We are therefore of opinion that the fuss which is being made about this southern block is just so much bluff on the part of those interested to create the impression of fictitious values, and the scramble for titles is intended to strengthen the impression that this Tom Tiddlers ground is a veritable El Dorado.

The coal block on the North Elk is a different matter altogether. There, it is not a question of coal either as to quantity or quality but of market. Already one large company—The Imperial Coal and Coke Co.—has been formed with a capital of $4,500,000 to purchase and develop 94 square miles of this area. Other large blocks containing from 20 to 50 square miles are held by speculators and it will yet become a matter of public interest and investigation to ascertain how such immense areas have passed into the hands of a few men—not in any case the original locators—even before the Government is in a position to grant licenses or issue any kind of title. That matter we waive for the present. Meanwhile we would point out that the Nest Pass Coal Co. have developed their mines to such an extent Crow's that they have not only overtaken the Canadian but the American demand. In a recent issue of the Fernie *Free Press* we read that the General Manager was in Montana seeking trade for the first time in the history of the concern; the B.C. Smelters were all fully supplied with coal and coke, and the mines at Fernie and Michel were working little more than half time whilst those at Morrissey were temporarily closed down.

In addition to this fact it must be borne in mind that the production of coal is increasing daily on the Alberta side of the Rockies where the output exceeds 1000 tons a day, and during the present season will reach 2000 tons.

In view of these facts there are two conclusions which seem irresistible. That money invested in East Kootenay Coal Mines will not, for many years to come, yield any returns to the investor except the satisfaction of seeing a few speculators and promoters line their pockets; and that the British Columbia Government would be well advised, having rescued blocks 4593 and 4594 from the grasp of one large corporation, to keep them permanently as a Government reserve selling a few miles at a time to "bona fide" coal operators as the requirements of the Province increase. Such a course would no doubt be a sore disappointment to the politicians of both parties who regard the public domain as their legitimate prey, but it would at the same time preserve for the public benefit the last of the invaluable coal lands of East Kootenay, and prevent millions from being squandered in a fruitless enterprise by unscrupulous promoters.

NELSON, 18th March, 1904. W. BLAKEMORE.

Mica Deposits.

By FRITZ CIRKEL, M.E., Montreal.

Mica, in its broader sense, comprises a group of minerals whose chief characteristics, distinguishing them from all the other minerals, are their great flexibility and micaceous structure, that is they have a highly perfect basal cleavage and yield easily very thin and more or less elastic laminae. If we split up a mica crystal into sheets and divide these sheets further, we find that their flexibility and also their transparent qualities increase with the division of the laminae, and this division may be continued to the thickness of 1/1000 of an inch, and more, if we had instruments fine enough to do this work. On account of these remarkable qualities mica has been used for ages in the arts, for many decorative purposes as screens, stove panels, lamp chimneys etc., and we find, that in the seventeenth century, white mica of a highly transparent quality was used as covers for dials of watches and in surveying instruments.

A further characteristic feature of the micas, is the production of so called percussion figures; the latter may be obtained if a crystal plate is supported upon a hard cushion and a blow be struck with a light hammer upon a steel rod. These percussion figures have been often investigated and consist of a six-rayed star, whose branches roughly speaking are parallel to the prismatic edges of the crystal. All species of the mica group crystalize in the monoclinic system, but with a close approximation to either rhombohedral or orthorhombic symmetry.

Chemically considered all the micas are silicates, in most cases orthosilicates, of aluminium with potassium and hydrogen, also also often magnesium, iron, sodium, lithium; further rarely, barium, manganese and chromium. Fluorine is prominent in some species and titanium is also sometimes present. All micas yield water upon ignition in consequence of the hydrogen which they contain. The amount of water in all micas being mostly between 4 and 5 p. c.

The application of mica in the arts, and to some part in technics as above referred to, having been very limited the mining of this mineral naturally was carried out on a very small scale in a primitive way and was practically of no importance, which is illustrated by the fact that, the statistical bureaus of the countries where mica mining is now successfully pursued, showed some 15 years ago a blank in the production of mica in their periodical publications, and it is not until the marvelous progress in electrical science, which is ever ready to replace seemingly high achievements of to-day by new and still higher ones of tomorrow, found a place for the successful application of this mineral in apparatus of various construction, that the mining of mica was seriously attempted. By a great many experiments in many of the electro-technical laborities it was established that, the most valuable property of mica is its electrical non-conductivity. From the date of this discovery the application of mica in electricity, more especially in the electric transmission of power, is general; mica has become a mineral of large economic importance, and if electricity progresses in the future as fast as it has for the last 15 years, there is no doubt that the economic exploitation of mica will form one of the chief resources of countries, where the same is found to exist in payable quantities. When we compare the mica industry in Canada of to-day with that of some years ago, we must come to the conclusion that the same has assumed large proportions, which may be seen from the fact that, while the production in 1900 was practically nil, the same reached in last year a total of about

$170,000 and if reports be true, that the supply of India mica is curtailed, the production will likely exceed this year $250,000.

The distribution of mica over the globe is very general ; it occurs in scaly particles as essential constituent of many metamorphic and eruptive rocks, such as gneiss, granite, porphyry and in this mode of occurence it is only of geological and lithological importance ; but as an economic mineral, as a mineral of commercial value, such as it comes here under consideration, we have to refer to the actual deposits of mica, containing mica crystals of large size which split up easily into laminae. Mineralogically speaking we have the following species :—

1. Muscovite : In composition it is a hydrous-potassium aluminium silicate (K_2O, $2H_2O$, $3Al_2O_3$, $6SiO_2$) usually called potash mica (Germ : Kali–glimmer.) It has mostly a clear, white color and constitutes most of the white mica of the trade.—It has a ruby color in India.

2. Phlogopite : Chemically speaking similar to Muscovite, but contains Magnesium, generally called Magnesium mica. It is mostly of amber brown or black color and constitutes the greater part of the amber mica of commerce, as found in Canada.

3. Biotite : Magnesium iron mica, generally black in color.

4. Lepidolite or Lithium Mica : This mica is comparatively rare, usually pink in color. It occurs very seldom in crystals, but only in flakes and scaly particles.

5. Zinnwaldite : Lithium Iron Mica, in form near biotite. The color is pale violet, yellow to brown and dark gray. It occurs at Zinnwald and Altenberg, Germany ; also in Cornwall.

Of the above five species only the first two are of commercial importance, while the other three are only interesting from a mineralogical point of view.

I. Muscovite is the most common of the micas. It is named from Vitrum Muscoviticum or Muscovy glass, formerly a popular name of the mineral. The distribution of this mica is very general all over the globe, but only in a few countries can muscovite mica in payable quantities be found.

The occurrence of this mica is confined more or less to pegmatite dikes, which in character may be called a very coarse granite, consisting of feldspar and quartz in variable quantities. These pegmatite masses occur in rocks of archaean age and comprise all the members of this formation from the lower Laurentian up to the Cambrian. According to I. A. Holmes,* in crystalline rocks exposed in the lower part of the Grand Canon of the Colorado in Northern New Mexico, the dikes break through the granite rocks and are of pre-Algonkian age. In most cases all the larger dikes in the Rocky Mountains have been involved in schistose and other structural modifications of the crystalline rocks, and consequently must have been formed either prior to, or during the earlier stages of the uplift of the mountains. In the Appalachian region these dikes generally are observed in connection with the schistosity of these rocks, although considerable changes of the adjacent rocks are noticeable. The condition of the material in the dikes suggests their formation either prior to, or during the early stages of, the uplift of these mountains.

In the pyroxenic region of the county of Ottawa the pegmatite rock differs from the usual varieties of this class of dikes or veins found in the Laurentian formation inasmuch as it is usually much finer grained ; it occurs also as veins intersecting the gneiss in approaching the great masses of anorthosite and gobbro. Dr. Ells in his investigations found that the quartz feldspar of the pyroxene, frequently cut the gneiss along the line of the strike of the dikes, like the latter, but its intrusive character is clearly evidenced in most cases by the sending off of spurs into the mass of gneiss in contact, as well as by the fact that it frequently cuts directly across the gneiss and intersects also the pyroxene, thus demonstrating its later intrusion. Inclusions of grayish or reddish gneiss, which is penetrated by these rocks, are also frequently found in the mass both of the pyroxene and feldspar, and furnish further evidence of the intrusive character of these rocks. In some places the presence of three distinctly intrusive dikes is recognized in the same opening, the oldest being the pyroxene, the second cutting the pyroxene is a pegmatite and the third is a black trap rock.

As to the constituents of the pegmatite dikes, either feldspar or quartz predominates, an even distribution of both through the dike is not generally observed.

Apart from muscovite there are many accessory minerals found through the vein matter such as a rare earth ; monazite, pitchblende, uraninite. In several of the Quebec deposits, pitchblende containing Radium, is reported to occur in payable quantities. The largest and best developed crystals occur in the pegmatite dikes associated with granitic intrusions either directly cutting the granite or in its vinicity. They are often associated with crystallized orthoclase, quartz, albite, apatite, tourmaline, garnet, beryl etc. and other mineral species characteristic of granitic veins.

Muscovite crystals generally speaking do not occur in payable quantities in pegmatite dikes of less than 2 feet in thickness, but this does not say that every dike of larger dimensions necessarily contains mica. We have instances where large dikes measuring over 200 feet in width contain no mica at all. According to the experience of the writer muscovite mica in workable quantities occurs—although there are exceptions to this rule—either on the hanging or footwall of the pegmatite dikes ; the same occurs in single crystals imbedded in the matrix, or in small or larger pockets of irregular shape, in chainlike accumulations of crystals, or in so called stock-werke of smaller dimensions.

We find that occasionally the sheets of the mica have been folded under pressure ; often such are useless for commercial purposes on account of producing the so called ribbon mica, the sheets being cut into narrow strips with parallel edges. These parallel edges of the rolled mica appear in all cases to be parallel to certain axes of crystallization, but the real cause of this rolling and the conditions under which it has been produced cannot well be determined.

From the foregoing it is evident that the material to be blasted down and removed must be necessarily large in order to obtain the commercial product, and according to manifold experience it is a fact that only a very small percentage of the deposits discovered warrant the expenditure for their exploration. As to the crystals or books, as they are generally termed, the size of them varies considerably ; while one dike may contain only crystals of small size of say, one or two inches larger axis, with very few larger crystals scattered through the matrix, another may contain only the larger size from 2 inches upwards and may yield a very fine commercial product. Many of the latter hold inclusions of foreign substances as quartz, feldspar, tourmaline, calcite and flattened crystals of garnet between the sheets ; further, not infrequently magnetite in dendrite like forms follows in part the direction of the percussion figure. A muscovite crystal generally with a few local exceptions splits to perfection ; it can

*Paper read before the 11th annual meeting of the Geological Society of America.

be divided in a great many fine laminae of great transparency and these as a rule are very elastic. The best qualities, or those which are used for ornamental work, have a clear white color; others, like the India mica, a ruby to rose color; others again have a greenish or grey tint. Reddish spots of iron and tourmaline, as in the Villenuve mine, are frequently met with, in some cases to such an extent as to render the crystals unfit for the use white mica is generally put to. For commercial use the crystals are split into sheets of $\frac{1}{16}$ to $\frac{1}{32}$ of an inch in thickness; the rough edges and parts are taken off by hand by thumbtrimming, and the sheets cut into the required sizes 1″ × 2″, 1″ × 3″ etc.

As to the percentage of merchantable mica in a pegmatite dike, experience in this direction shows that, a dike containing about 5% of useful mica crystals in the rough state, of fairly good quality, and allowing $\frac{3}{5}$ of this mica for waste—in others words that a mine yielding about 2% of trimmed mica should under ordinary circumstances (taking labor and locality into consideration) pay handsomely.

The localities where the mica deposits are found are very numerous and only those which are interesting by reason of their extent or geological features, will be described: In Canada, in the province of Quebec, in the vicinity of Tadousac, 10 miles from the shore of the St. Lawrence, veins of pegmatite traverse the country rock, mainly consisting of feldspathic and dioritic gneisses, and contain mica crystals irregularly distributed through the vein matrix. The dimensions of these veins are in some cases very

Tadousac Mine, Quebec.

large, being 200 to 300 feet in width, while the length is from several hundred feet up to one mile. Veins of these dimensions, however, do not pay to work; veins of 20 to 30 feet width, exhibiting a fair amount of crystals generally pay to work. Crystals of black tourmaline are frequently met with, while many classes of rare earths as monazite, uranite, cerite and pitchblende are constituents of these veins. The mica coming from these localities is of excellent quality, being remarkably clear from spots, while the cleavage is perfect. The main vein of the Beaver Lake mine in the Terrebonne township is 140 feet wide and exhibits a fair quantity of irregularly distributed crystals, some cutting 4 × 6 inches. In the township of Villeneuve north of Ottawa muscovite mica occurs in a vein of pegmatite measuring 135 feet in width, and cutting through the gneiss. It is a transparent mica, thicker laminae showing a greenish tint, sometimes with inclusions of iron and tourmaline. Other accessory minerals like cerite, pitchblende and monazite are frequently met with.

A sample of Uraninite has been analyzed by the United States Geological Survey and gave the following :—

Oxide of Uranium	37,90
Oxide of Thorium	6,41
Oxide of Cerium	0,40
Lanthanium and Yttrium	3,68
Lime	0,39
Oxide of lead	11,27
Water	1,47
Silicates and other minerals	1,28
	100,72
Density	9.055

The feldspar found at the Villeneuve mine is of a very pure quality; it is entirely free from iron as is seen from the following analysis, compared with the theoretical analysis of pure orthoclase feldspar :—

	Villeneuve Mine.	Theoret. Analysis.
Silica	63,96	64,61
Alumina	19,16	18,49
Potash	16,88	16,90
Iron	traces	——
Magnesia	——	——

Villeneuve Mine, Ottawa County, Ont.

Some very large crystals have been taken from this vein, one giving sheets of 30 × 22 inches; another crystal weighed 500 pounds and realized 500 dollars. The Villeneuve mine has yielded some 35,000 lbs of merchantable mica, and the writer is of the opinion that, if mining towards the depth of this mine would seriously be attempted, mica in payable quantities may be found.

There is a large field for the prospector of white mica in the Lake Manowan region, 250 miles north of Lake St. John; at Watshesha on the gulf of the St. Lawrence about 400 miles below Tadousac and also at Lake Pieds des Monts, 17 miles north of Murray Bay. This latter mine has come into prominence lately by the discovery of pitchblende, an uranium oxide, containing Radium; it is reported that this mine contains this mineral in payable quantities. In this connection it may be mentioned that in the Province of Quebec where the Laurentian formation is developed to a very large extent, the pegmatite dikes or veins,

which all more or less contain muscovite mica, are closely associated with the rare earths especially uraninite, containing Radium. Here is a very large field for research work and it is not improbable that many abandoned mines may be exploited in in future for this mineral, which now is found only in very limited quantities.

The Maisonneuve mine, situated on lots II, 1-2, of the Township of Maisonneuve, Berthier, is reported to have a very good vein of pegmatite with an appreciable amount of fine mica crystals, resembling those at the Villeneuve mine. In association with the black tourmaline and garnet we find Samarskite of brownish black color. This mineral, according to an analysis made by Dr. Chas. Hoffman (Geol. Surv. Ottawa, 1880-82) contains the following:—

10,75% oxide of Uranium.
14,34% oxide of Yttrium.
4,78% oxide of Cerium.

It appears that this mine, being situated so far from railroad connections, (80 miles in a northern direction from St. Felix de Valois C.P.R.), and therefore difficult of access, has not been worked continuously.

In the township of Bergeronne, 11 miles from the little Bergeronne Bridge and 15 miles from Tadousac, the Hall mine was for years a prominent producer of very fine transparent mica. The pegmatite vein on this property strikes in a N.E. direction and can be followed for over one mile in length, but only the northern part of this vein has been prospected and to some extent developed; it has produced a considerable quantity of mica cutting 4″ × 5″ and 5″ × 6″.

In the province of Ontario, several deposits of promise have been discovered, but so far none of them have been worked to any extent. In the township of Aylwin, about ½ a mile north of Venosta station a vein of pegmatite cuts through a grayish garnetiferous gneiss and it is reported that some large crystals with excellent sheets were obtained.

In the Parry Sound district, in the township of Proudfoot, a coarse and fine grained gneiss occurs, containing biotite and gray muscovite mica. Various masses of fine grained diorite penetrate the gneiss and a great number of pegmatite dikes. These dikes have attracted the attention of prospectors on account of the beautiful crystals they contain; they vary greatly in size and composition, but even the narrow veins hold sometimes mica crystals of an excellent quality. In one of these dikes which is of very large extent, the various minerals are gigantic in size, microcline crystals reaching a length of three or four feet, and mica crystals yielding plates 8 × 10 inches in sizes. Both varieties of mica occur here, biotite and muscovite, the latter only on account of its perfect quality and cleavage being of commercial value.

In British Columbia, some mine deposits have been exploited in the vicinity of Tête Jaune Cache, about 150 miles north-west of Donald on the C.P.R. According to Mr. Mc Evoy* the mica occurs as a constituent of coarse pegmatite veins, which cut the country rock, consisting in that locality of garnetiferous mica schists and gneisses with some blackish mica schists and light colored gneisses that resemble foliated granitoid rock, the garnet mica schist being the predominating rock. The pegmatite vein has a width of 15 feet giving sometimes crystals cutting 18″ long and 11″ wide; these crystals are generally found on the hanging wall, while some are irregularly distributed through the vein. The mica is a transparent muscovite with a very light greenish tint and appears to be of excellent quality. There are a number of other deposits of this mica in the same locality and, according to all appearances, there is a probability that this region will produce an appreciable quantity of very fine clear mica, which, on account of its higher prices will be used for ornamental purposes only. A great drawback however, to the proper exploitation of these deposits is the lack of access and communication, all supplies being carried in by pack trains over trails which for the larger part of the year are in bad condition.

In Labrador, near the head of Lake Winokapan, fine large crystals of a greenish tint and perfect cleavage were observed by Low in red pegmatite dikes, cutting through the archaean rocks, but here also the inaccessibility of this region is a great hindrance to the development of these occurrences.

In the United States the mining of mica is confined to the States of New Hampshire, North Carolina and South Dakota although there have been a great many other deposits discovered, the quantity of mica coming from these sources is insignificant.

The most important producers in New Hampshire are the mines at Grafton, Danbury and Alstead. According to A. Hoskins* the old Ruggles mines in Grafton have produced mica for over 100 years, yielding an aggregate of over 8 million dollars worth of mica; these mines at one time furnished four-fifths of the total output of the United States. Owing to litigation which has extended for over 20 years, the mines have lately not been in operation to their full capacity, no machinery of any kind being employed and drilling is done by hand. The crystals are split into sheets of an eigth of an inch thick and the rough edges trimmed with a knife. The dealers cut it into different shapes and sizes required by the manufacturers.

At Danbury there are 2 mines in operation, one, the Empire Mining Co., being considered a good paying mine. The quality of this mica is excellent, it being free from spots and very clear. In Alstead there are three mines in operation: The Davis, the Hoskins, and the Warren French mine. The Davis mine is a large producer and considered one of the best paying mines. The mica is trimmed and shipped to Boston. The other mines are reported to deliver a very good quality of sheet mica while also a large quantity of scrap mica is produced.

In Idaho the Idaho Mining Co. is developing their many claims on Bear Creek, 13 miles from Troy, Latch County. The vein is reported to be 30 feet wide. In the beginning of 1903 the output was 2 tons per week.

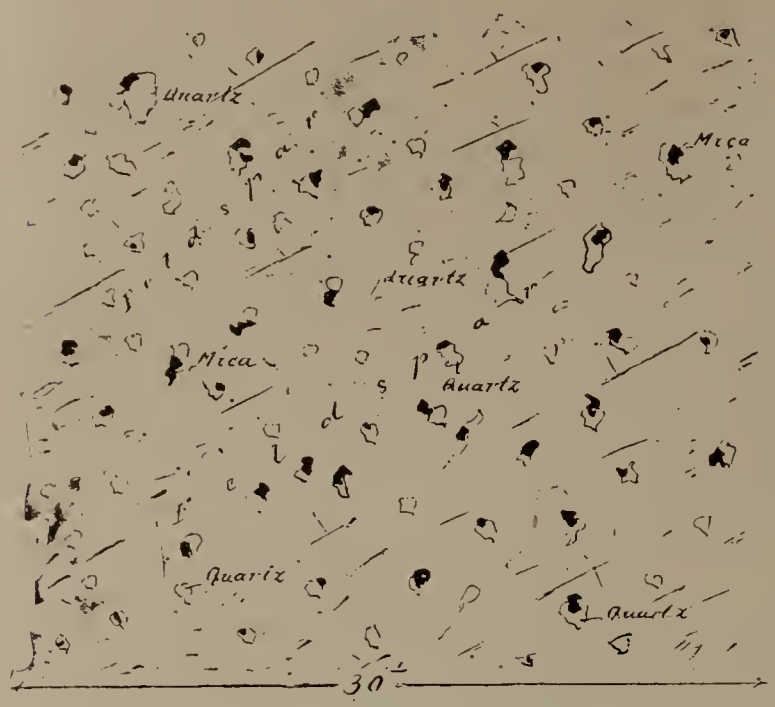
In North Carolina the principal mica deposits occur in Mitchell, Yancey, Jackson, Haywood and Macon counties. Many mines are in operation in those localities, most of them on a small scale, the mica constitutes about 1 to 10% of the pegmatite veins.

In South Dakota, Custer County, the Black Hills Porcelain, Clay and Marble Co. operate several mines. In the beginning of 1903 this Company shipped 30 tons of mica. The Crown mine, owned by the Chicago Mica Co. covers 40 acres in Custer County and is shipping regularly two carloads of mica (mostly for grinding) to the company's plant at Indiana. Dr. E. A. Smith* reports a discovery in Alabama in the north-western part of Randolph and the adjacent parts of Cleburn and Clay Counties. The mica occurs in veins of a coarse grained granite, in which the constituents assume gigantic proportions, often making masses of a

* Rep. Geol. Surv. 1898 iii S.

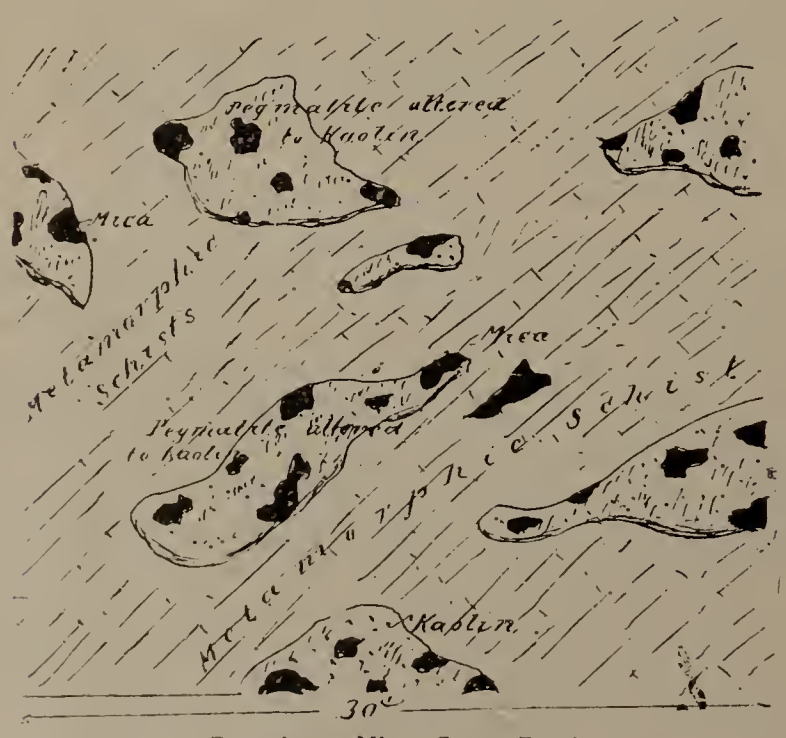
* Min. Ind. 1898 P. 507. Min. Ind. 1898 P. 478.

foot or more in size. The mica boulders, as they are locally termed, deliver sheets of large size and excellent quality.



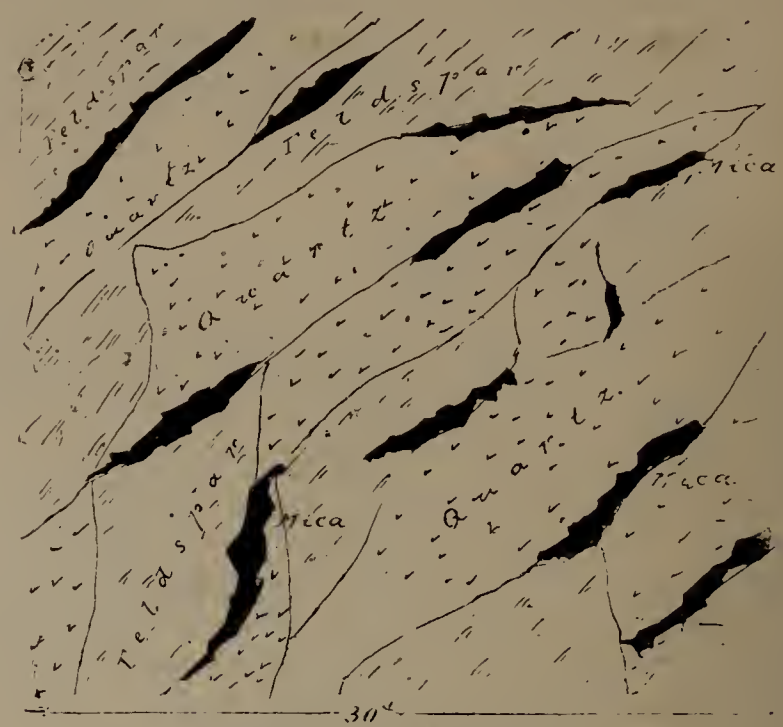
Alabama, U.S.A.

In Brazil, according to H. Kilburn Smith, mica occurs in workable quantities in the States of Goyaz, Bahia and Minas Geras. In the State of Minas Geras the mica is found in pegmatite veins, lenses or dikes in metamorphic schists near the city of Santa Lucia de Carangala, the veins running parallel to the Cayama and Papgais mountains. The deposits are generally altered to Kaolin and vary in width from 20 inches to 10 feet. There are about six mines which have supplied mica for export, only two of them, the Fonseca and Coronel Seraphino mines, being worked regularly. The Fonseca mine has produced about 30 tons of trimmed mica, the larger portion was used for decorative purposes and lamp chimneys. The total output of the Seraphino mine is 20 tons; about 50% of this output has been obtained in sheets of over 6 inches in length. The approximate cost per ton of mica at ports in U.S.A. or Europe is £63. The Brazil mica is considered the finest on the market on account of its great transparency and absence of any spots. It is largely used for ornamental purposes.



Deposits at Minas-Geras, Brazil.

In Norway the Godjeld mine near Skutterud on the south west coast has come into prominence by reason of the peculiar mineralogical character of the mica crystals. In all the crystals the two basal planes are never parallel to each other and consequently the majority of plates split out of a crystal are thicker at one end than at the other. The mica occurs in lenses or shoots between quartz and felspar or wholly in quartz. The shoot varies in dimensions, extending either across the vein as a whole, between felspar and quartz or entirely in quartz. The color of the mica is green, but a greater part is of brown coloration, due to numerous stains. These



Deposit at Godjeld Mine, Norway.

stains are mostly observed on the surface, they seem to disappear in depth. Many crystals from this mine although of perfect form have inclusions of garnets, tourmaline and of many other minerals which render a great many sheets out of a crystal useless. At a depth of 60 ft. the character of the mica begins to change considerably and although these crystals yield a small amount of sheets, still a great many of them are full of foreign matter so that they split up in flakes and scaly particles. Further a good many crystals have undergone an entire change, a greenish steatitic material taking the place of mica. This material is in places compact while in others it becomes earthy, occasionally fibrous and silky, and it hardens shortly after exposure to the air. The mica when it is first taken from the mine, is very soft, but after a few months it becomes much harder and less pliant.

From China it is reported that vast untouched deposits of mica have been discovered at Kiao-Chau Bay. Nothing further is known except that some of the mica is discolored by foreign substances. The veins are said to be up to 10 ft. wide and to contain a fair amount of commercial sheets.

(To be continued)

Magnetic Separation.

By F. T. Snyder, Oak Park, Ill. *

Everyone is familiar with the simple fact that a magnet will pick up small pieces of iron; many persons are familiar with the fact that sufficiently powerful magnets will attract a large number of materials in which the presence of iron is, at least, not in evidence, but few persons realize that the design of magnetic separators and the practice of magnetic separation have developed to a

* Paper read before the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

point where it can be stated that there is no material which cannot be moved by magnetism if the commercial conditions under which its movement is desired will permit of the necessary expenditure. For many materials this cost is usually prohibitive, but, as a curiosity, pieces of wood, apples and other things generally considered magnetically inert, have been moved through distances of several inches.

In the early days of magnetic attraction, previous to half a century ago, it was generally thought that the law of magnetic attraction was simple, and even quite recently it has been stated in textbooks that the attraction of a magnet for a movable particle varied directly as the strength of the magnet and inversely as the square of the distance. This, in common with the other simple laws of natural phenomena, has proved to be simple only under theoretical conditions which are not secured in practice. However, the law of movement of a free particle in a magnetic field was understood and perfectly formulated at least a half century ago. In such formula the distribution of the field is assumed as known, while it is from this factor that the complications in the theory of magnetic attraction usually occur.

The early types of magnetic separators consisted of a straight bar permanent magnet or an equally simple electro magnet. The material to be separated was either touched by one end of this bar or allowed to fall near it and in that way dragged out from the non-magnetic material. From this were developed numerous types of machines, similar in theory but better in mechanical form. Two troubles which developed were, first, the entanglement of non-magnetic material by the material attracted, and second, the question of getting the attracted material off the magnet again so that the magnet could operate continuously. Most of these machines were weak and applied to highly magnetic materials only and as the results were indifferent, the commercial growth of the industry was slow. During this time—that is, in the period of the last twenty years—the question of magnetism has come to be relatively very well understood in connection with the design of dynamo machinery, and as the necessity for magnetic concentration was urged with more and more persistency, it eventually fell into the hands of competent dynamo designers. The result was magnetic separators of greatly increased power, and from them has developed a knowledge of the design of such separators which makes it possible to-day to build a separator which will handle practically all materials, the limit being that the more difficult the material is to handle, the greater will be the cost of the machine, and consequently the less return commercially. This great advance in design was largely due to the conception of a magnetic field as made up of lines of force which are assumed to emerge from a pole-piece of one polarity and pass through the air to a pole-piece of opposite polarity. In the production of this magnetic field the conditions are similar to those in an electric circuit, the magnetism produced being the equivalent of the current. The magneto-motive force due, in electromagnets, to the current circulating in the windings of the coil, is the equivalent of the electromotive force in the electric circuit, while the resistance of the magnetic circuit is analogous to the resistance of the electric circuit. It was early seen that a large portion of the cost of exciting a magnet was due to the resistance of the parts of the magnetic circuit at which the lines of force were compelled to jump through air, air having a very high magnetic resistance as compared with iron. In an endeavor to reduce this resistance, the air path was shortened by bringing the magnet poles close together. In the early types of machines the material to be separated was passed through the field in such a manner that both of the poles were on the same side of the material so that in falling, the material passed through the loops of the lines of force twice. It was this looping of the lines that led to the entanglement of the non-magnetic materials with the magnetic materials and it was this entanglement that eventually led to the abandoning of this looped field type of machine for the type where the material to be separated passes between the poles and through the magnetic field but once and in consequence escapes entanglement.

The freeing of material which had been attracted was at first secured by means of scrapers, and later by reducing the field at the point where the material was desired to be freed, but it is now generally obtained in the best machines by reversing the magnetism, producing a neutral point at which all material of whatever attractability is dropped. So well have the principles of the design of a magnetic separator come to be understood that a difference of magnetic susceptibility now offers in many cases a cheaper way of concentrating minerals than the customary way of taking advantage of the difference in specific gravity.

From its highly attractable property and from its low value, which prevented ordinarily any other method of concentration, iron ore has naturally been a special field for magnetic separation. This has been with two specific ends in view, one, the enrichment of a low-grade iron ore for the purpose of reducing the freight to a furnace, and also the furnace cost of operation per unit of iron smelted. The other use has been to free the iron from deleterious materials, such as titanium, phosphorous and sulphur. Where these occur in separate crystals which can be liberated by crushing the iron ore, the resulting separation is one which frequently proves commercially feasible. In the case of sulphur, the success depends on the fact that the sulphur compounds usually found in iron, are either more or less magnetic than the iron oxides of the ores.

The separation of iron has divided practically into the separation of magnetites—that is, iron oxide, which is naturally magnetic and can be picked up with an ordinary hand magnet—and the hematites and limonites which are less magnetic, usually so feebly magnetic as not to be attracted by a hand magnet.

In the enrichment of hematites the question has divided into two different sorts of separation, one, the separation of high-grade hematites from a sandstone in which they occur as a conglomerate, having been deposited as detrital material from older iron beds along with the sand ; the other, the separation of siliceous material which was originally deposited at the same time as the iron and usually in the form of intimately entwined cyrstals.

The question of the physical condition of iron ore with reference to its impurities, is one of the more important in the magnetic concentration of such material. One of the first of the questions which are asked by a furnace man when approached on the subject of iron concentrates is "the amount of fines." If it is necessary to crush the material to such fine sizes that most of it will blow out of the top when put into a furnace, the purchase of any considerable tonnage of such material is evidently a matter to be approached with caution. Briquetting has made material advances, and large experiments are being carried on at present in the smelting of briquetted iron material. It should be noted that this matter of briquetting and the production of fines is entirely a question of the physical character of the ore. Magnetic separators now handle such feebly magnetic materials as hematite in chunks of practically any desired size, separators being constructed to concentrate material up to one inch in diameter. The cost of

building and operating a separator increases about in proportion to the size of material which it has to handle. It is therefore a commercial matter as to whether the cost of briquetting, or the cost of concentrating at a larger size, out-weigh one another. Almost invariably it is cheaper to build a machine capable of handling larger sizes than it is to briquette, as in general briquetting costs more per ton than the cost of separation, including interest, depreciation and royalties on the separator when handling material as large as one inch in diameter.

In such a matter as the St. Lawrence iron sands, where the material is already crushed, and generally crushed even finer than enough to free it from the accompanying gangue, the question of briquetting is an important one and bears an aspect which should interest Canada with its water powers. The need of briquetting iron ore for use in a smelting furnace is brought about by the high pressure of the modern blast. If this blast could be eliminated, within certain limits it would be a matter of indifference as to whether the material were coarse or fine. It would still have to be granular enough to permit the escape of the gases generated in the smelting operation. Electric smelting provides the required condition that there need be no blast. The magnetites, being iron oxides, need only be mixed with carbon in the shape of any clean fuel, such as coke or charcoal, and subjected to the heat generated by an electric current, to have the carbon join with the oxygen of of the magnetite and escape as carbon monoxide, leaving the iron to be tapped off in the form of pig. These St. Lawrence magnetites could probably be dredged up and concentrated wet into an iron ore of unusually high grade, and delivered in the Ottawa valley for a cost not to exceed one dollar per ton. Their commercial utilization by means of magnetic separation would appear to offer the promise of a very considerable industry when taken in connection with smelting by means of the water power of the Dominion.

Of next importance (commercially) from the standpoint of magnetic separation is the separation of the mixed sulphides of lead, zinc and iron. This so-called "Leadville problem" has existed for many years. There was in this camp a large tonnage of zinc-lead ore which was too high in zinc to permit the lead furnace man treating it without getting into serious difficulty through the choking up of his stack from zinc accretions, and too high in lead and iron to permit the zinc smelter from treating it without the destruction of his retorts through slagging by lead and iron. The specific gravity of the zinc and iron was too close to permit of commercial water separation. Through zinc interests who were looking for an additional supply of zinc ore, this problem was attacked along the lines of magnetic separation, and in its solution was secured much of the data which now forms the basis for an established magnetic separation industry. A parallel problem existed at Broken Hill in New South Wales, Australia. Here the lead and zinc were so intimately mixed that when crushed to the proper mesh for separation, a large amount of the lead was lost by sliming, and the zinc concentrates which were secured were too low in grade to stand the freights to a European smelting point. Here, as at Leadville, the introduction of magnetic separation has resulted in the utilizaiion of a very large tonnage of what was heretofore waste material. In British Columbia there exists a similar problem. It might be pointed out that there existed two different ways of handling this problem. The mixture of zinc and iron sulphides may be roasted to reduce the iron sulphide, which normally is almost entirely non-magnetic, to a form of a highly magnetic sulphide, or it may be roasted further to bring the iron to the condition of a magnetic iron oxide, in either of which conditions it may be removed as the magnetic product. Operating in this way the cost of roasting is involved, and an additional loss due to the fact that if such roasting be deferred until the zinc smelter is reached, the sulphur can then be utilized in the manufacture of sulphuric acid. At Leadville and at Broken Hill the ore is not roasted, it being the zinc that is pulled out as the magnetic product, the iron sulphides remaining behind as the non-magnetic product. There is reason to think that this would be the better commercial way of doing it in British Columbia in those cases where the zinc sulphide is sufficiently ferruginous to permit it. Such is usually the case where the zinc is black, or, as the miners speak of it, "Black-jack".

Third in commercial importance has been the separation of manganese. Manganese, as is generally known, is used in the manufacture of Bessemer steel to which it is added in the form of ferro-manganese or speigeleisen for the purpose of reducing the oxides formed by overblowing the charge. For the purpose of making ferro-manganese the commercial requirements are for an ore that carries 50% of manganese. The tonnage of ores of this class is rather limited, while there is an enormous tonnage which carries from 5 to 15% of manganese. This is too much manganese to permit the ore being used as an iron ore, and it is not enough manganese to enable the ore to be used for the production of ferro-manganese. The magnetic separator enables the owner producing material of this character, to separate it into two products one a 50% manganese ore, and the other an iron ore carrying two to three per cent. in manganese, so making out of an unsalable product, two products, both of which find sale. In this separation either the manganese or the hematite may be the more magnetic product, depending on the local peculiarities of the ore handled.

The magnetic separation in which Canada is especially represented is the cleaning of corundum. A commercial sample of Canadian corundum purchased in Chicago was found to contain something over 10% of magnetite. Passing this over a magnetic separator, the magnetite was reduced below 3%, the change representing an increase in the corundum contents from 89% to 97%. Further experiments along this line seem to indicate that if desired, the iron could be sufficiently removed from the aluminum oxide to render corundum a possible ore for the smelting of aluminum.

The attractability of hornblende has been utilized in connection with the concentration of metallic copper. In ores of this character the gangue, which was almost entirely hornblende, was pulled away as a magnetic product from the copper, leaving a copper ore which was sufficiently rich to smelt directly for copper, although the original ore carried less than 1% of copper.

Another interesting separation has been the handling of mica as a magnetic product. This may be utilized in two ways, for the extraction of mica from other material as an impurity and also for the concentration of mica for use in making mica insulating materials.

Of all recent developments of the magnetic separating methods, the more important is the fact that the cost of such separation is now generally below that of the equivalent water concentration, so that even in cases where water concentration is particularly adapted technically, as in the separation of chrome ores from serpentine, the magnetic method still proves the better commercially. It was this very low cost of magnetic separation that enabled concentration to succeed in the enrichment of hematite after water methods had failed commercially. One fact of advantage in magnetic separation is that it can be made, as desired, either wet or dry.

It occasionally happens that the freight on moisture contained in an ore shipment to a smelting point, is a sufficient item to warrant drying it. In this case if the ore is reasonably dry as it comes from the mine, the magnetic separation can be made dry, saving the cost of drying. On the other hand, if moisture in the ore is immaterial, either from freight considerations or from the smelter's standpoint, and it occurs in a wet mine, it is possible to put it through the magnetic separator without drying, shipping the product as it occurs. This is of special importance in connection with the St. Lawrence magnetite sands. The cost of drying that material before separation would probably prohibit its commercial utilization. As it is, such sands can be dredged up by any economical form of suction or dipper dredge and sluiced through a machine with an adequate supply of water, and produce a concentrate which can be drained to less than 15% of water without artificial heat.

As illustrating the results which are being obtained at present by means of magnetic concentration, there are exhibited samples showing separation on the magnetite ores of Cornwall, Pennsylvania, of iron pyrites and talc from magnetite, representing a reduction of sulphur from 2½% in the original ore to less than ⅓% in the cleaned ore. Samples of magnetite extracted from the St. Lawrence sands show an iron content of 69.3% with a trace of titanium, leaving a sand tailings carrying 2.8% iron.

As illustrating the enrichment of hematites, two samples are shown, one being the separation of hematite and sandstone, producing an iron concentrate carrying 65% in iron and .008 in phosphorous, and a sandstone tails carrying 8% in iron, .04 in phosphorous, showing a most interesting elimination of the phosphorous from the iron compound. The second being the separation of hematite and jasper, the hematite product carrying 50% iron, jasper 13%. In connection with the hematite samples it will be interesting to note the size, the material having been crushed to pass a 4 mesh screen.

As illustrating the iron-zinc separation at Leadville, samples are shown, assaying for a zinc product 46% of zinc and 3.2% iron, and for the iron product, 37% iron and 7.3% zinc. The equivalent samples for the Broken Hill ores were tails carrying 8% in zinc and heads 48% zinc.

From the manganese industry samples are shown representing the concentration of Utah manganese from silica and gangue, the manganese being enriched from 15% to 41.8%.

From the field of corundum cleaning two samples were shown one being material at 20 mesh, showing cleaned corundum having .08% of iron and a magnetite which had been taken from the corundum carrying 65% in iron. Corundum at 100 mesh showed only a trace of iron after having been cleaned and produced heads running 63% in iron.

Another sample of the concentration of magnetite was shown in the concentration of black sands from placer workings. In this case the concentration was 20 to 1, ilmenite and some of the rare metals being pulled away from the gold and other sands leaving a concentrated product which would stand shipment to a smelter.

The production of mica for the year 1903 as reported by the Department of Mines of the principal producing provinces is as below :—

Ontario, lbs.....	1,896,000	$102,205.00
Quebec, "	280,624	74,119.00
"	2,186,624	$176,324.00

Exhaust Steam Boiler Feed-Water Heaters; Hot Water Pumps and Pumping.

By W. D. L. Hardie, C.E., M.E., Lethbridge, N.W.T.

We do not know of any subjects more worthy the attention of mining men than the two we have adopted as titles for this paper. It is the purpose of the writer to rehash, in this paper, much that may be old to many of our members but of great importance to the younger ones who have not travelled over the whole of the subject of discussion here, and also to give some information that has come to the writer in his practice.

The primary object of a heater is to raise the temperature of the water and thereby increase the efficiency of the boiler plant, either by reducing the coal consumption or increasing the capacity of the boiler plant ; but there are several other objects to be gained of nearly as much importance as the primary one. If these were named in the order of their importance they might take the following classification :—

1. Increase of temperature of feed water.
2. Reduction of danger that is due to effect of cold water on boiler plates when under high pressure.
3. Precipitation of a large percentage of scale-forming matter before it enters the boilers.
4. Reduction of scale in boiler, which is another great source of increased usefulness of the boiler plant.

It is fairly well known that sulphate of lime and magnesia in connection with sand and other earthy matter, are the large scale formers. Sulphate of lime will not precipitate at less than 300° F., and can not be eliminated by an exhaust steam heater without the aid of chemicals, but the carbonate of lime and magnesia &c., can be precipitated at from 160° F., to 204° F., which is quite within the range of exhaust steam heaters. These in many water supplies form the large percentage of impurities. In most cases under my own observation, if bad mine water be excluded, from 75% to 85% of the impurities, in water objectionable to boiler feed, can be precipitated within the temperature of exhaust steam.

There are, strictly speaking, two distinct classes of Feed-water Heaters—the open and the closed, but these two classes have innumerable divisions. The closed water consists of a shell with coils of pipes within, and has two principal divisions :

1st. The water is pumped through the coils and the steam is exhausted into the shell which surrounds the coils, heating the water as it passes through the coils into the boilers.

2nd. The steam is exhausted through the coils and the water gravitates, or is pumped, into the shell and from there re-pumped into the boilers.

The open heater consists of a shell into which the steam is exhausted.

This class of heater has a large number of divisions, the principal ones being :—

1st. The heater in which the cold water is allowed to gravitate into the shell, and from there pumped into the boilers. The exhaust enters at one end and escapes at the other.

2nd. The heater in which the water gravitates into the shell, and from it pumped into the boilers. Exhaust steam is attracted by vacuum into the shell. The steam has no thoroughfare through this heater.

3rd. The heater in which the water gravitates, or is pumped through a coil into the shell, and the exhaust enters one end of the

*Paper presented at the sixth annual meeting of the Canadian Mining Institute, March, 1904.

shell and exits at the other. The hot water is pumped from the shell into the boilers.

In the case of the closed heater, if used simply for heating pure water by radiation, good results may be expected, but in the case of impure water it can not remove any of the impurities or prevent formation of scale in the boilers. If sufficient temperature is obtained to set free and precipitate the earthy salts in the feed water, they will settle on the surface of the tubes and form scale, and reduce the efficiency of the heater. In the best makes of this class of heater all possible arrangements are made for cleaning but it can scarcely be said that they are ever entirely satisfactory. Our own experience is that this class of heater requires much care, and considerable expense in overhauling and repairing. We will, therefore, dismiss the closed heater and deal more particularly with the open heater.

Prof. Chandler, the chemistry expert, says that—"Boiling water expels the free carbonic acid and causes the separation of the carbonate of lime and magnesia." This is precisely the function of the open heater. If the carbonic acid gas, hydro-chloric acid gas and other gases, and the majority of the scale forming matter can be extracted from the water before it enters the boilers we have gained a great end. It must be remembered that the evil effects of scale are due to the fact that scale is relatively a non-conductor of heat. It has been demonstrated that scale 1/16 of an inch thick requires the extra expenditure of 15% more fuel, and the proportion increases with the thickness of the scale; when scale is ¼ of an inch thick 60% more fuel is required, and at ½ inch thickness of scale 150% more fuel is required. These figures are appalling but true. However, the worst features are as follows: to produce steam at 90 lb. pressure per square inch the temperature must be 320° F., which may be secured by heating the external surface of a ¼ inch plate to 325° F., but if ½ an inch of scale is on the internal surface of the plate 700° F., will be required—a mighty good reason to keep the scale producing matter as low as possible.

But there is still another very important point which I wish I could impress very strongly on the younger members, viz: at any temperature above 600° F., iron soon becomes granular and brittle from carbonization, a condition of high class cast iron; this produces weakness of the plates and causes repairs, and predisposes to sudden explosions.

We think it a fair proposition that, except where more than ordinary care is taken, about ⅛ an inch thickness of incrustation will take place on the boiler the first year, and increase at a greater rate each succeeding year. This is more especially true of boilers that have parts not easily accessible.

In addition to extracting the earthy salts from the feed water, the open heater has the other advantage of condensing the exhaust steam into pure water for boiler feed, thus reducing the amount of water required by as much as 5% to 15%. For example, take 6 lb. of water out of the exhaust steam which is at a temperature of about 212° F., and, at the same time, raise the temperature of the whole to about 212° F., so that for 6 lb. of water at 50° F., delivered into the heater we get 7 lb. of water into the boilers at 202° F. With the closed heater, in getting 7 lb. of water into the boilers at 212° F., we would have sent 1/16 into the atmosphere as exhaust steam. The condensed steam ordinarily amounts to about 1/6 of all the cold water used. It would seem that steam space is not of particular advantage so long as the cold water is properly broken up so that the steam may be brought into contact with it, and there is sufficient space for the passage of the steam through the heater without lifting water and without creating any back pressure. However, some manufacturers of exhaust steam heaters make the rule of allowing one half square foot of heating and catching surface and 34/4 lb. of water for each horse power. In such heaters no filtering arrangement is made, dependence being put altogether in the iron trays used for breaking up the water and receiving the deposits.

By the following excerpt from an old writer we see that an open heater with the trays on an old boiler shell is a very old idea.

"At East Howle Colliery, Durham, England, the exhaust steam is turned into an old boiler. Cold water enters at the top and is allowed to fall on to a series of horizontal trays placed one below another in step form. The feed water is heated to 200°F and is then forced by a donkey pump into the boiler."

It will be objected by the closed heater advocates that we have not said anything about the very objectionable feature of the oil going into the feed water of the open heater with the exhaust. Later on we will give a description of several open heaters which will show how this objectionable feature is eliminated, but just now we will take the case of an open heater which consists of simply an old boiler shell set either longitudinally or upright with an inlet and outlet for the exhaust. In such an arrangement the water is always carried at some distance above the bottom, and the outlet to the pump is high enough at some part in the suction pipe to prevent the water falling below this line if the float did not sufficiently control the cold water supply. This causes the oil to float on the surface of the water and to be blown off at regular intervals. This method is practiced at some collieries with marked success. The heavy impurities are precipitated to the bottom of the heater, which is cleaned out regularly.

With open heaters the maximum attainable temperature in the water, if the amount of exhaust steam is sufficient in amount, should not be more than from 1°F to 4°F less than the temperature of the exhaust steam when entering heater. The saving of fuel, or what is the same thing, increased capacity of the boilers, should be 1% for every 10°F the temperature of the water is raised. When the boilers are forced, or inferior coal is used, the percentage of saving, or increased capacity, is greater.

In the writer's opinion, where the water is particularly muddy or contains lime, magnesia, etc., a filter should form part of the heater, otherwise much of the scale forming matter, after being precipitated, is pumped into the boilers and there formed into scale, and one of the principal benefits of the open heater lost.

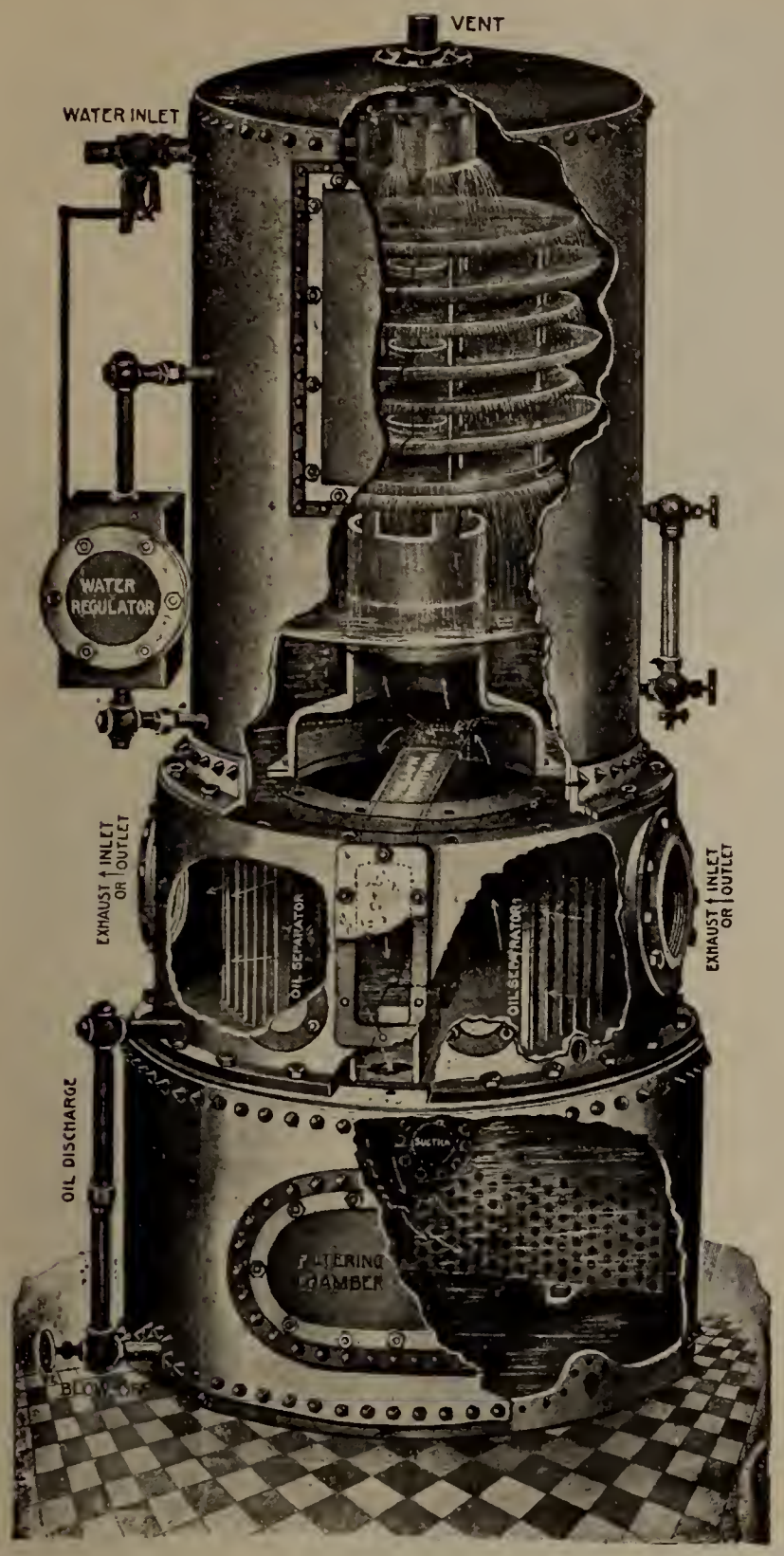
When the feed water contains incrusting materials not disengaged and precipitated at the temperature of the exhaust steam or by the filtration of the feed water, an apparatus should be attached to the heater by which the feed water can be treated with the proper chemicals to separate and remove the scale forming materials before they are pumped into the boiler.

Water impregnated with large quantities of sulphates of lime, and magnesia,, and little carbonate or silicate of lime will cause a soft formation inside the heater, mostly on the pans, but if pumped into the boiler will give a very hard scale.

In the case of heaters part of which consists of a filtering arrangement, there must be sufficient water carrying capacity to permit a very slow travel of the water through the filtering material.

Following are given cuts and descriptions of a few of the best open exhaust steam heaters on the market today.

HEATER.



DESCRIPTION.

Exhaust steam is admitted from either side and exhausts from the opposite side. The steam enters from the right hand side, as shown, strikes the "V" shaped oil-separating plates which divide the volume of steam; the ribs on these plates catching the oil and moisture in the steam, the separation is completed by the expansion of the steam in the chamber. The purified steam then enters into the enlarged portion of the exhaust tube (same being cut away to show its course) where it passes into the opposite expansion and oil-separating chamber where the steam is further purified, and discharges to the atmosphere or heating system. At the top of the heater is a vent pipe for carrying off the air and gases relieved from the water in heating. This vent pipe must be connected with the exhaust outlet or atmosphere, the air being thus removed from the upper, or heating chamber. The cold water supply from the city mains, or tank, now entering in a spray condenses the steam, forming a vacuum which draws the required amount of steam to heat the water up the large tube in the centre. But only that amount of steam necesssary to heat the water comes in contact with it, the balance passes on in its dry purified state to the heating system or atmosphere.

The water supply is connected to the water inlet valve which is opened and closed by the water regulator, maintaining at all times a uniform water level in the heater. The water entering the spray box at the top of the heater overflows in a spray to the pan below; overflow from this pan sprays into the next. The water passes from this second pan through its centre to the next pan below, and so on down. The last pan is bolted to the top of the exhaust tube. The water sprays from this last pan to the water below. All pans with the exception of the bottom one are loose, made in halves, and are readily removed through the manhole. The object of these pans is to catch the lime deposit. The water after having been heated in direct contact with the steam enters the hollow partition at the back of the exhaust tube. (The dotted arrows show the water entering the opening in the hollow partition). The water discharges from the hollow partition near the front into the filtering chamber below, where the remaining impurities in suspension are removed by filtration. It is obvious that the water in the hollow partition is kept at boiling point, by having steam on both sides of it at all times. The filtering chamber is filled with coke or excelsior and at the back of this chamber is a perforated plate preventing the filtering material from passing through to the pump. A strainer plate is also placed at the blow off connections. The blow off and oil discharge pipe must be placed on the side opposite the exhaust inlet; openings are tapped for that purpose. The two oil separating chambers are connected by a small opening through the hollow portion at the bottom, through which the oil and condensed water drain from one chamber to the other. All chambers are provided with a large manhole, and manholes for cleaning. The manhole in the upper chamber is hinged, making it an easy matter to open the heater for examination and the removal of the lime catching pans. Exhaust flanges, suction and return flanges are also removable; and a heater will be furnished with any sized flanges desired up to the capacity of the heater. The water inlet valve is balanced, having a double valve, and is made entirely of brass. The water regulator contains a seamless copper float; and all connections, stuffing-box, etc., are of brass to prevent corrosion.

CONSTRUCTION.

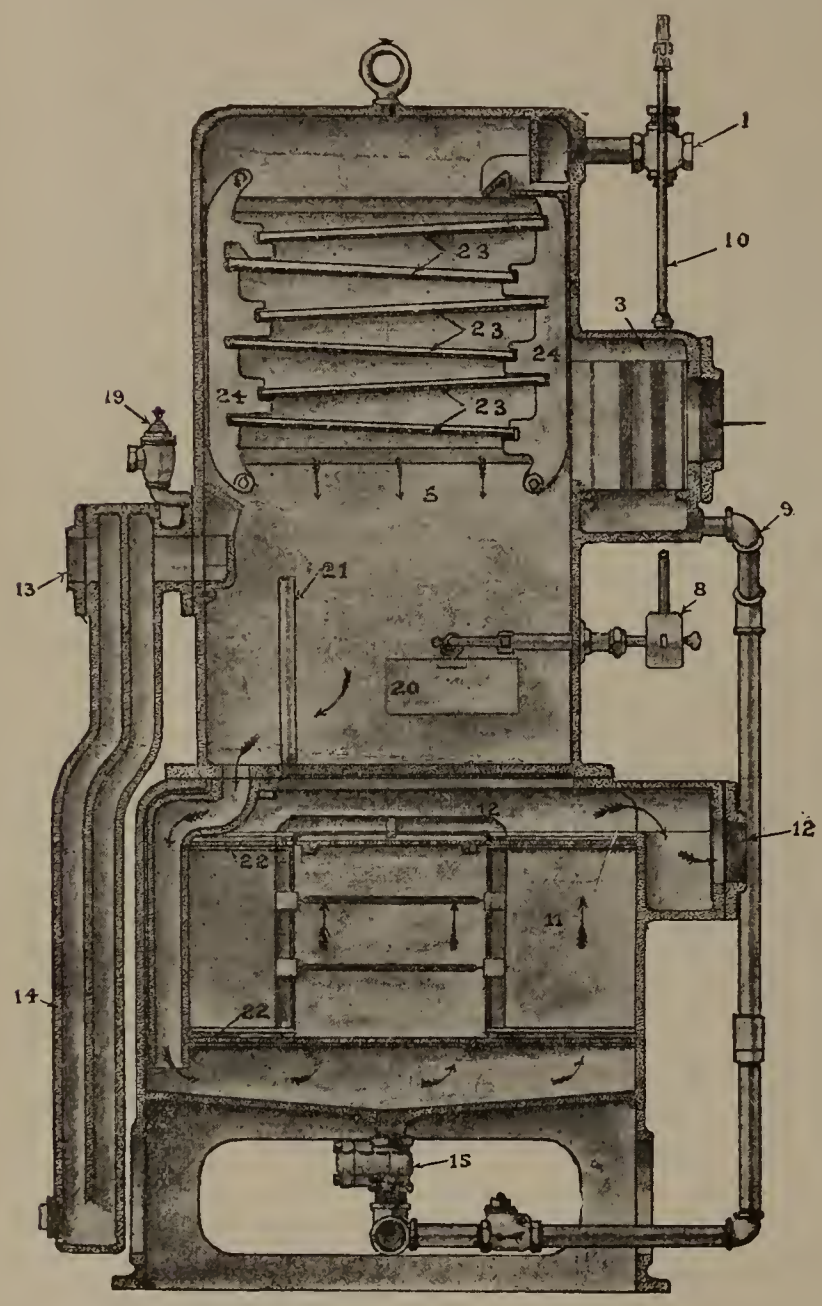
It is constructed in part of cast iron and steel plate, and in such a manner that it can be taken entirely apart with a monkey wrench. Being made on the interchangeable plan, any parts may be duplicated in the event of accident or partial destruction by fire. The top section is of steel plate, the centre section is of iron and in a single piece, including the shell, top and bottom heads, oil separating plates and the two walls forming the hollow partition. The bottom section or filtering chamber is made with a heavy cast iron bottom and cast ring at the top to which the steel shell is rivetted. For heaters of 400 H.P., and under, this chamber is made of cast iron and in one piece. These three sections are securely bolted together with special gaskets and constitute the main structure of the heater.

DESCRIPTION.

1. Water controlling valve.
3. Oil separator.
4. Exhaust steam outlet.
5. Heating Chambers.
8. Counter-balance weight for sink pan.
9. Oil drip connection with check valve.

10. Connecting rod between sink pan gear and water controlling valve.
11. Filter chamber.
12. Pump suction chamber.
13. Overflow connections.
14. Overflow seal.
15. Drain valve.
19. Combination shifting valve for ventilating heating chamber and relieving excessive vacuum and pressure.

HEATER No. 2.



20. Open sink pan, controlling water regulating valve.
21. Vent pipe, to prevent accumulation of air at top of suction chamber.
22. Upper and lower retaining screens for filtering material.
23. Perforated copper heating trays.
24. Heating Tray Brackets.
25. Water inlet seal trough.

This illustration shows clearly the construction and operation of the vacuum feed-water heater, purifier and filter.

Materials used in its construction are cast iron for the shell, copper and brass for the valves and fixtures, each of which resist the destructive action of impure waters. The large heating chamber, upper section of the heater, is provided with perforated copper trays for the distribution of water, as hereinafter explained. The entire valve gear, automatically controlling the water supply, is of brass.

As will appear from illustrations, the shell is of cast iron, rectangular in form, and composed of two single piece main castings, securely bolted together.

The heater has an inclined bottom to facilitate thoroughness in draining, and is amply strengthened for the pressures obtaining in ordinary practice. Access to the interior may be had by removing the manhole doors located in both the heating and filtering compartments, the latter forming the heater base.

The water supply to the heater is controlled automatically, the valve for this purpose being operated by an open gravity sink attachment, by which the inlet of water to the heater is increased or diminished, as may be necessary to furnish the required amount of feed water for the boilers, and also maintain a uniform water level within the heater.

The steam supply is drawn to the heater through a branch from the main exhaust pipe with a valve in it. This abrogates the necessity of expensive piping and further abrogates the difficulty attending taking all of the exhaust steam with the oil through the heater. *It also prevents the waste of water absorbed by the uncondensed steam passing through the heater.*

In the rectangular casting forming a steam connection to the heater there is placed an efficient *oil separator* of large surface, so constructed of steel baffles that the entrained water and oil are conducted to a receiving well at right angles to the flow of steam. The oil present in the exhaust is thus effectively separated and removed through a drain pipe of ample size provided for this purpose.

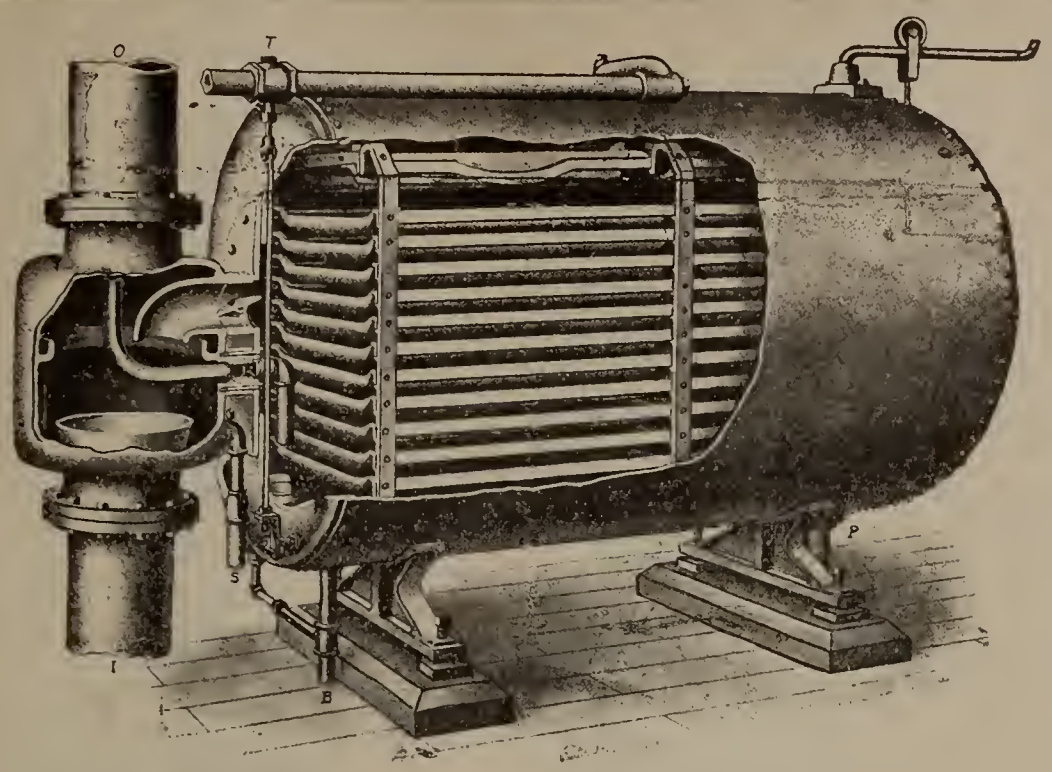
The feed water enters the heater through the water inlet at the top and is discharged into and fills a trough, forming a water seal, thus preventing the familiar water hammer, which is caused by steam entering the water pipe when only partially filled. The water overflowing through the trough is then distributed over a series of oppositely inclined, perforated copper heating trays, which in their vertical arrangement are staggered, so that the water on its downward course falls from tray to tray and passing through the perforations is broken up in small particles, whereby it becomes thoroughly mingled with exhaust steam and absorbs all the heat possible. In leaving the trays the water falls upon a plate on a heater which separates the heating chamber from the filtering chamber.

The filter is located in the lower casing and operates in the following manner: After becoming heated to the highest attainable temperature, the water in the heating chamber passes through a down-cast pipe into the settling chamber, above which the filter bed is located. In this settling chamber opportunity is given for the precipitation and retention of the heavier solids and impurities without clogging the filter. On account of the large size of this chamber the water entering it remains in an almost quiescent state, insuring the rapid deposit of the heavier solids from the feed water. The water then rises upwards through the cast iron perforated screens which hold the filtering material in place, through the filtering material and upper screens to the under side of the division plate, whence it travels to the pump outlet.

It will be manifest that the filtering material, as arranged, has only to deal with the lighter impurities in the feed water, the heavier particles having been deposited in the settling chamber.

The filter bed is commonly composed of coke, excelsior, or other suitable material, which are contained between the perforated division screens.

The overflow for ordinary service in heating, purifying and filtering feed water connection is made to the regular overflow outlet on the heater.



DESCRIPTION.

The above cut shows another type of vacuum heater. By the use of this attachment great saving in the pipe work, valves and fittings for connecting the exhaust supply to the heater is effected. By this arrangement no valves are required for the exhaust pipe connections to the heater in order that the heater may be cleaned or examined while the plant is in operation.

As is clearly shown in the illustration, the exhaust enters the bottom of the chamber and passes out at the top direct to the atmosphere, or to the heating system, as may be desired. The exhaust steam flowing upward through the induction chamber strikes directly into the mouth of the large downwardly curved pipe and supplies the heater with an ample amount of pure exhaust steam to heat the water to 210 degrees, even when the heater is worked to more than twice its rated capacity.

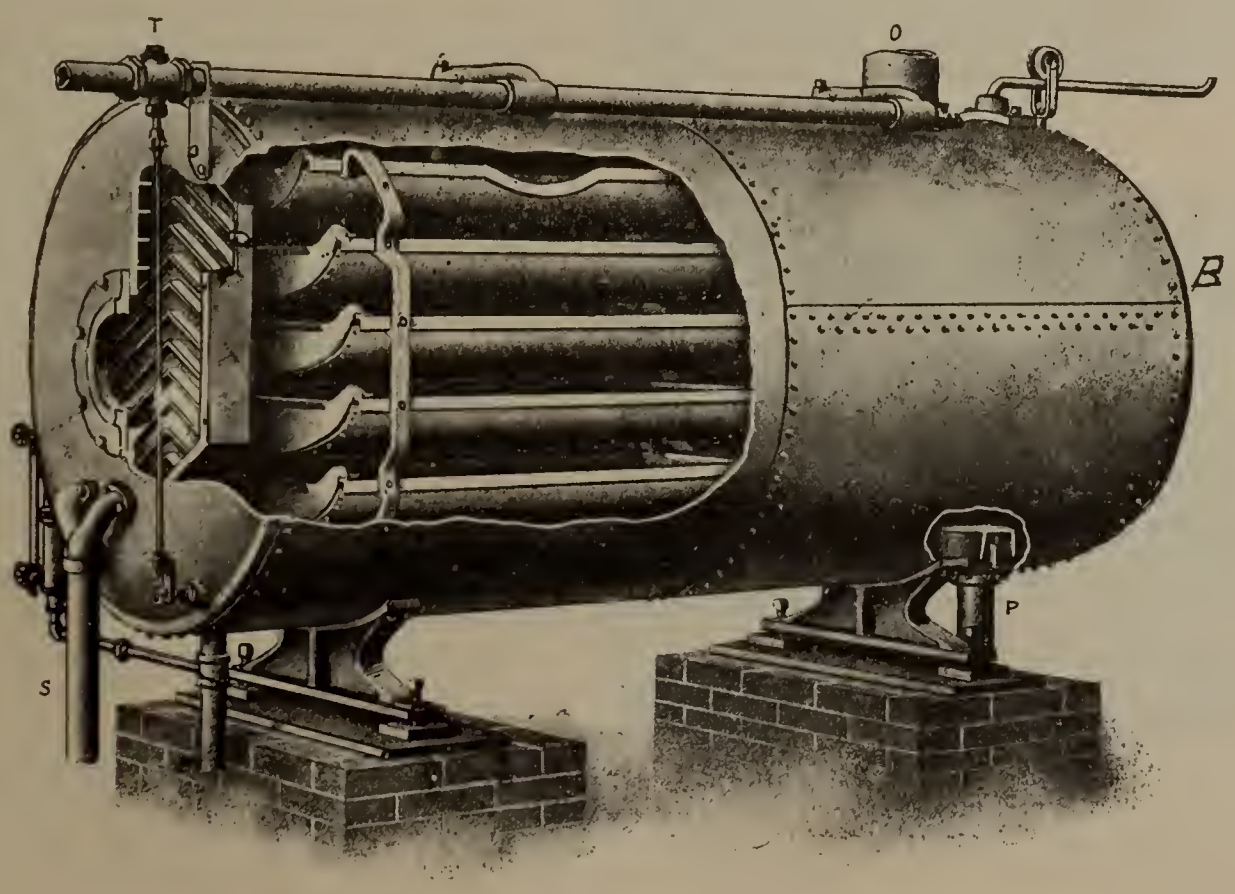
To allow the steam to enter the heater it is necessary that the air and gases be permitted to escape, and this is accomplished by heating the small curved pipe where it passes through the chamber and also by the current of exhaust steam passing the upper end of the pipe.

The attachment is also a first-class oil eliminator and grease extractor. It is a well known fact that oil and water follow the inner walls of the pipe, and when steam enters the chamber this entrainment is first carried over the edges of the flaring nipple extending up into the body. This nipple and the inner walls form an annular well which is always partially filled with water, the surplus being always drawn off by the drain pipe. Just above the centre, and extending around the inner wall is another gutter which is also partially filled with water, the excess being drained off to the lower well by the small pipe shown at the side. This gutter is intended to catch any oil that may creep up the sides of the chamber and to secure its complete interception.

In the last two of the heaters just described the vacuum principle is adhered to, and it has also had attention given to it in the first one, although the exhaust travels through it.

DESCRIPTION.

This heater consists of a cylindrical shell of steel plate, and is provided with neat cast iron heads, the front one, B, of which is removable for taking out the pans and for access in cleaning. The exhaust steam enters at the back end, and, after passing through



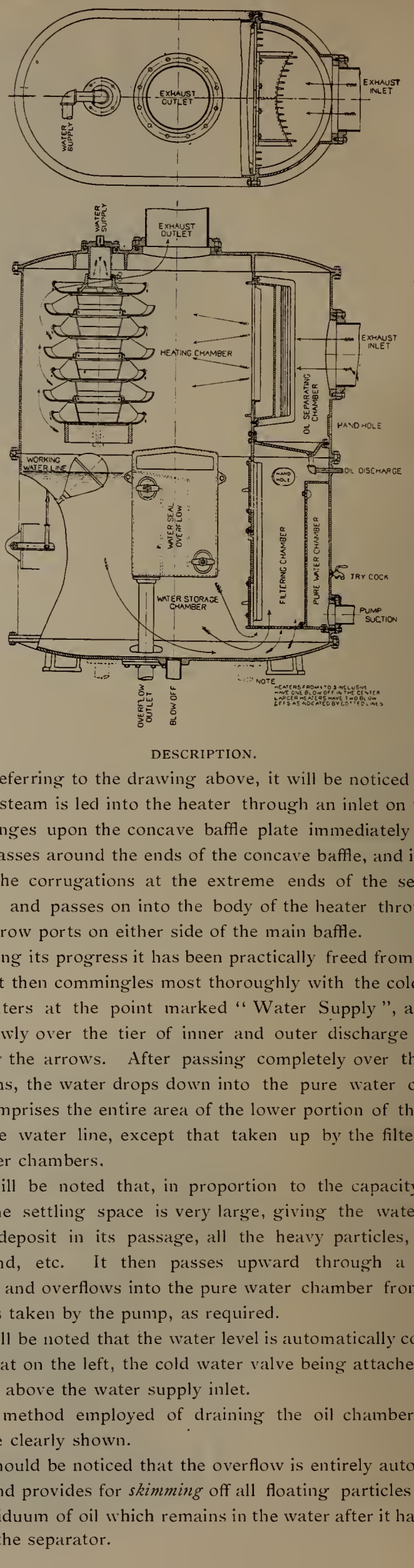
an ample self-cleaning oil catcher, A, enters the heater proper, from which it escapes through the pipe O on top, and at the front end. The pipe S is the drip pipe leading from the oil catcher to the sewer.

The admission of water to the heater is automatically regulated by a drained float, shown underneath the oil catcher, by operating the balanced valve at T. The float may be put in an upright 8″ or 10″ pipe attached to the suction if desired, in which case the balance valve will be at the other end of the heater. The water on entering the heater falls into the top pan first and flows downward over each pan to the chamber at the bottom of the shell, from which it passes to the pump through pipe P.

While in operation the pans are full of water and are completely surrounded by the exhaust steam in the shell. Owing to the convex shape of the bottom of the pans, the water is caused to flow in a thin film along the under side in such a manner that the exhaust steam always comes in contact with it, and thus heating it to the highest degree obtainable without back pressure. The pans afford ample settling chambers for the mud and solids in suspension to precipitate, and the lime and other solids in solution form, as fast as liberated, into scale on the under side of the pans.

It is claimed by the makers of the above last two heaters that no filtering arrangement is required because the pans thoroughly remove all the impurities that can be taken out or precipitated by exhaust steam. In support of this a cut of the pan before use is shown, and another cut of the same pan after having been in use in the heater for forty-two days.

Our experience would indicate that a filtering arrangement would be of considerable advantage.



DESCRIPTION.

By referring to the drawing above, it will be noticed that the exhaust steam is led into the heater through an inlet on the right and impinges upon the concave baffle plate immediately in front. It then passes around the ends of the concave baffle, and is thrown against the corrugations at the extreme ends of the separating chamber, and passes on into the body of the heater through two long, narrow ports on either side of the main baffle.

During its progress it has been practically freed from cylinder oil, and it then commingles most thoroughly with the cold water, which enters at the point marked "Water Supply", and flows down slowly over the tier of inner and outer discharge pans as shown by the arrows. After passing completely over the entire set of pans, the water drops down into the pure water chamber, which comprises the entire area of the lower portion of the heater below the water line, except that taken up by the filtering and pure water chambers.

It will be noted that, in proportion to the capacity of this heater, the settling space is very large, giving the water ample time to deposit in its passage, all the heavy particles, such as mud, sand, etc. It then passes upward through a filtering chamber, and overflows into the pure water chamber from which point it is taken by the pump, as required.

It will be noted that the water level is automatically controlled by the float on the left, the cold water valve being attached on the pipe, just above the water supply inlet.

The method employed of draining the oil chamber of oil is also quite clearly shown.

It should be noticed that the overflow is entirely automatic in action, and provides for *skimming* off all floating particles and the small residuum of oil which remains in the water after it has passed through the separator.

The heater is supplied with handholes for cleaning out the oil chamber, and also for washing out the filtering medium. Unless it is desired, there is no possibility of back pressure on this heater, on account of the fact that the outlet is made the same diameter as the inlet. The large hinged door provides almost instant access to any part of the heater.

The system of upward filtration should always be given much consideration, as it not only makes it possible to use the same filtering material for a much longer time, but prevents absolutely any floating particles from going into the boilers.

In connection with any heater there should be a by-pass, so that the steam can be turned into the heater or into the atmosphere at will.

(To be continued.)

The Lead-Mining Industry in British Columbia.

(From our Special Correspondent)

Mr. G. O. Buchanan, the Government Agent for the distribution of the lead bounty in British Columbia, has completed his task to date and the total amount paid out is $120,000. This represents the arrears that had accumulated from the date that the bounty became operative and covers a period of nine months. From now the returns of shipments will be made monthly, and after being checked will be certified for payment, and the amount be disbursed month by month. From the above figures it might appear that only a small portion of the total bounty granted, viz: $500,000, will be earned; such a conclusion however would at least be premature. The payment is certain to be very much larger than indicated by the monthly earnings so far, whether or not the Government consents to the payment of a portion of the bounty on exported ore. If however, the request of the lead miners in this respect be refused, there will be a large increase in tonnage over 1903. Local opinion inclines to the belief that the St. Eugene will work to its full capacity whether the export bounty be granted or not, as development work is being pushed rapidly and every preparation is being made for a busy season. Apart from this, however, a stimulus has been imparted to the industry throughout the the Slocan. More men are working than at any time during the last three years, the last estimate being 750. Many small mines are being re-started, and the principle of leasing, so well adapted to this camp, is spreading. The effect of Government aid was slow in manifesting itself, probably because of the delay in providing for and paying the bounty, but as soon as it was seen that the help was really forthcoming and that market conditions were improved there was a steady increase in production. It is gratifying to be able to note that the machinery to handle this matter is running without friction, and that all parties are satisfied with the treatment they are receiving. The recovery has come none too soon, for things were looking very blue throughout the Slocan, and one of the most important and legitimate industries in the West was languishing almost to the point of extinction.

MINING NOTES.

NOVA SCOTIA.

The Intercolonial Coal Co., Westville N.S., are to put in a new and larger air compressor to supply the requirements of No. 4 slope.

The Nova Scotia Steel and Coal Co. has chartered for the season some 16 steamers to carry its coal and iron ore.

The Fundy Coal Co., near Amherst, N.S., are to increase their plant to a capacity of 1,000 tons per day. The Company controls 10 square miles and are working a seam with an average thickness of 6 feet.

Sydney despatches state that orders to relight all idle open hearth furnaces have been given and that large orders for billets and rods have been booked. Two furnaces are now in blast, and the other two are being relined.

The output of the Dominion Coal Co., for the four months ending May 1st, was 864,736 tons. The daily output ranges from 13,000 to 14,500 tons, and since navigation on the St. Lawrence river opened the shipments have averaged nearly 8,000 tons per day.

Under date of the 13th instaut, it was reported that two of the collieries of the Dominion Coal Company were obliged to stop cutting coal as all available space for banking purposes was filled. Over 120,000 tons are reported to be banked awaiting shipment. Shortage of vessels for shipment is reported as the cause. The Company's operations have been considerably hampered by the lateness of the spring, which has been unfortunate by reason of the large contracts which have been entered into.

A liquidator has been granted by the Supreme Court of Nova Scotia for the Canada Coals and Railway Company, more familiarly known as the Joggins Mines Company. Under the winding up order granted, Mr. James Rodger, representing the Gault interests, was appointed to the position. The present corporation was formed some 12 years ago, and has never paid a dividend. The seam is thin and the fire-clay band is thick, and to these natural difficulties was added the burden of heavy fixed charges and gross over capitalization,

NEW BRUNSWICK.

The Canadian Coal Mining Co., operating in New Brunswick, have applied for a charter to build a railroad from their mines to the Intercolonial Railway. The distance is eight miles.

QUEBEC.

The Summer School of Mining and Geology for McGill University left Montreal on the 25th of April accompanied by Professors Adams, Porter and Stansfield. The students were nineteen in number, and the first stop for work was made at Sudbury, Ont. Here courses in metallurgy under Prof. Stansfield, and in field geology under Dr Adams, were given. The party then proceeded to Alberta to study the coal deposits at Frank and the Crow's Nest Pass. It will visit the St. Eugene mine and mill in East Kootenay and will take in as much of British Columbia as can be accomplished in the six weeks ending June 4th.

ONTARIO.

Reports from the Sultana Mine continue to be of good character, and the ore that is being mined has a satisfactory profit margin.

A Winnipeg telegram advises that a mining revival in the Keetwatin District is probable, and states that ten stamps in the Sultana mill are dropping on ore coming from the fourth, seventh and eighth levels.

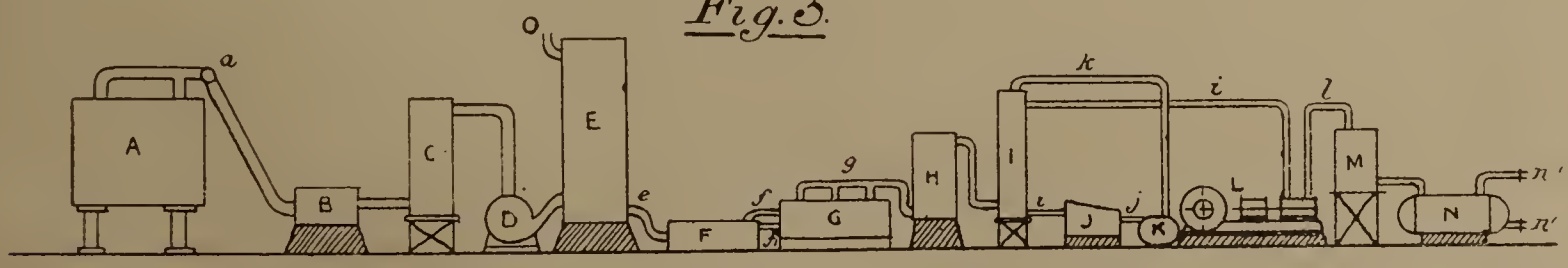
The Bureau of Mines reports the discovery of iron ore (hematite) 60 miles north of North Bay in the Temagami Reserve near Rabbit Lake. Particulars as to quantity and quality of the ore have not been ascertained.

The Twentieth Century Mining Co., report that the shaft has now reached a depth of 100 feet, and that ore from the bottom is of good value. Levels have been started off at 80 feet, which, so far, have also shown good values.

Ontario enjoys the distinction of having a "lady" mine owner and mine operator, Mrs. C. A. Bridgewood, who is working mica mines in Haliburton Township. Mrs. Bridgewood states that she is operating at a good profit, and proposes to start a form of co-operative mining among the farmers:—they will do the mica mining, and she will buy the product, trim it and morket it.

A reported discovery, which may be of great importance, is said to have been made on Hunter's Island, a few miles north of the Vermillion Iron Range of Northern Minnesota. The ore is both specular and hematite, and is said to be low in sulphur, phosphorous and silica. The location is accessible from a point on the Port Arthur, Duluth & Western Raiiway, about 100 miles west of Port Arthur.

Fig. 3.



The above is the correct cut for Fig. 3 of Mr. Sjostedt's paper printed in our April issue; the cut given as No. 3, was one which was sent to us in error.

The Bureau of Mines has announced that the summer schools, under the direction of Dr. W. L. Goodwin assisted by Mr. J. W. Bain, will hold sessions as follows:—Bannockburn Pyrite Mine, May 2 to May 8; Olden Zinc Mine, May 10 to May 17; Radnor Iron Mine, May 19 to May 26; Craig Corundum Mine, May 26 to June 3; Haileybury Mine, June 6 to June 13; Greighton Mine, June 16 to 23; Massey Copper Mine, June 25 to July 3; Superior Copper Mine, July 5 to July 12; Location A.L., 282, July 15 to July 22; Gold Rock, July 24 to July 31; Sultana Gold Mine, August 3 to August 10.

BRITISH COLUMBIA.

Mr. J. L. Parker, late superintendent of the North Star Mine at Kimberley, East Kootenay, has been appointed to the superintendency of the mines of the Brown Alaska Co. on Prince of Wales Island, Alaska.

A 50-ton Hendryx Process plant has been contracted for by A. H. Kelly to be placed upon the property of the Reliance Gold Mining and Milling Co. on Forty Mile Creek, below Nelson. Mr. Kelly expects to have the plant in operation some time in July.

Continued good reports of the operation of the Iowa-Lillooet dredge have been received, and if they are substantiated, the gold industry along the Lillooet, and portions of the Fraser River, will be rehabilitated to a marvellous extent.

On Boulder, McKee, Spruce, Pine and Birch Creeks, and on the Stevenduke lease, piping water for hydraulic sluicing will begin shortly. Preparations are all ready. On Boulder Creek and on Spruce Creek individual miners, operating by hand, are taking out very good gravel.

The Oro Denoro mine, in the Boundary District, is making changes and installing additional machinery to enable it to ship 250 tons a day. The present capacity is 150 tons per diem, and this output has been maintained for some time. A new superintendent has been appointed in the person of Mr. F. W. McLellan, who comes to the Oro Denoro from the Sumpter District in Oregon.

Advices from the vicinity of Yale, B.C., are to the effect that numerous good strikes have been made in that district this spring. These strikes have been made in both placer and lode mines, and have attracted many prospectors from other parts of the province. Boston Bar and Hill's Bar, and Siwash Creek are the special localities mentioned.

On Siwash Creek there has been a development of free milling ore which is deemed sufficient for a new 10-stamp mill, the erection of which began this month. A 3-stamp mill and a 5-stamp mill have been at work on two other deposits with satisfactory results.

On the 10th instant Mr. Justice Drake of the Supreme Court of British Columbia, ruled that the majority value in the reorganization of the Lenora Mining Co should rule. The matter came before his lordship in an application to sanction the acceptance of the liquidator's offer made to the unsecured creditors of the old company. At a previous shareholders' meeting a majority of *votes* had been given against the offer, but a large majority of *value* was in favor of the offer. The substance of the offer made was that the owners of the Crofton smelter should take £100,000 in first preference shares and cash; the owner of the sawmill and 400 acres of timber land should take £10,000; the unsecured creditors to the amount of about £50,000 should take second preference shares for that sum, and the owners of the mine £100,000, with a reserve of £40,000 for working capital.

The judgment of His Lordship, Chief Justice Hunter, in the case laid against the Wellington Colliery Co., Ltd. for employing Chinese underground, is that the clause (34) of the Coal Mines Regulation Act, under which the charge was laid, is ultra vires of the province. His Lordship's judgment was concurred in by Mr. Justice Irving, the case having been heard by a special session of the Full Court. The information on which the original case was based was laid by direction of the Provincial Government. Clause 34 of the Act which is declared ultra vires reads: "No Chinaman or person unable to speak English shall be appointed to, or shall occupy, any position of trust or responsibility in or about a mine subject to this Act, whereby through his ignorance, carelessness or negligence he might endanger the life or limb of any person employed in or about a mine, viz; as bankman, onsetter, signalman, brakeman, pointsman, furnaceman, engineer, or be employed below ground or at the windlass of a sinking-pit."

The conditions under which the regulation quoted was enacted are well enough known to require no comment. The decision given by the Full Court is a distinct blow to the opponents of Chinese labor below ground in the coal mines of the province.

There is a return apparently to the old system of shipping out lead bullion from British Columbia smelters to the Selby Smelting Works, San Francisco. For a time after the lead bounty was put in force, it was noticeable that there was no lead bullion reaching the coast. It has been the practice in the past to ship several cars by each steamer which sailed from Vancouver for San Francisco. For a short time none was going south. In the last two or three trips, however, some lots have been arriving. Yesterday the steamer City of Puebla took out three cars of lead bullion to be refined at the Frisco works. The trip before, the Umatilla took out two cars. It is of course known that the bullion cannot all be treated at the new British Columbia refinery.

There are three freighting steamers, the Selkirk, Cascade and Oscar, engaged in carrying ore from British Columbia coast mines to the Tacoma smelter.

A rather peculiar law case arising out of conflicting mining regulations was disposed of by Judge Martin this week. The Lucky Jack claim in the Poplar Creek free gold camp was recently staked over as a placer claim by a prospector. There is a good deal of wash over the vein in places, consisting of boulders from the vein matter, which is at various places 80 ft. in width. If this were allowed to be worked as placer ground such a claim would be undoubtedly valuable. The learned judge in deciding the case ruled that such a claim was legally staked. Of course an appeal is to be taken. The placer claim is suggestively named the "Do Who."

NORTH-WEST TERRITORIES.

The International Coal and Coke Co. at Coalman, Alberta, is now shipping about 150 tons of coal per day. A force of men are at work on the coke ovens preparing foundations and getting in material for the bedding of the oven.

The Frank Mine of the Canadian-American Coal and Coke Co. has its main entry in a distance of 6,500 ft. reaching a vertical depth of over 1200 ft. The quality of the coal now mined and the amount of the output is greater than it was before the disastrons slide, which about a year ago completely closed all operations.

Mr. O. E. S. Whiteside, the general manager of the West Canadian Collieries, has placed Chas Emerson, formerly at Canmore, Alta., in charge of the Bellevue mine. The Bellevue is becoming one of the prominent mines belonging to the West Canadian Collieries; it furnishes about 150 tons per day of a superior quality of steam coal, all of which is supplied to the C.P.R. for locomotives.

YUKON.

James MacDermott, a claim jumper of White Horse, received the severe sentence of two years' imprisonment by the local judge last month.

The Commission appointed to examine into certain mining matters in the Yukon territory and better known as the Treadgold Commission, has been reconstituted by the appointment of Mr. Justice Britton as sole Commissioner.

Dr. G. C. Martin, the geologist who investigated the Alaska coal deposits in the summer of 1903, has reported that coal, very closely approaching true bituminous coal, has been found in quantity at the foot of the Chugach mountains on the United States side of the boundary. Dr. Martin also reports a seam 20 ft. in width, of a semi-anthracite on Carbon Creek. The tests made show it to be closely allied in heating power as well as in the low percentage of ash with the famous Pocohontas coal of Virginia.

The White Pass and Yukon Railway Co. has posted its tariff of rates into the new Alsek fields. From White Horse to Mendenhall for each passenger $10.00, return fare $7.50. Freight rates in either direction are 75c. per 100 lbs. For horses and cattle the rates are $7.50 per head into Mendenhall and $5.00 coming out back to White Horse. Each passenger is allowed 150 lbs. of baggage free. The distance from White Horse to Mendenhall is only 70 miles.

INDUSTRIAL NOTES.

Mr. H. F. Frevert who, for several years past has been the manager of the New York departments of the Niles-Bement-Pond Co. and the Pratt & Whitney Co., has severed his connection with the above concerns and has established a machinery office on his own account at 114 Liberty street. Mr. Frevert will also continue to represent the Norton Grinding Co. of Worcester, Mass., and the Brightman Manufacturing Co. of Shelby, Ohio.

Mr. H. V. Croll who has been in charge of the Salt Lake City, Utah, Office of the Allis-Chalmers Company, for several years, and who was before that the representative of the E. P. Allis Company at Spokane, Washington, has been appointed to the charge of the Allis-Chalmers Office in San Francisco, as the successor of Mr. Geo. Ames, who has resigned. Mr. Croll's San Francisco Office is 623 Hayward Building.

A new corporation known as Allis-Chalmers-Bullock, Limited, announce that they have taken over the business and representation in Canada of the Bullock Electric Manufacturing Co., Canadian Bullock Electric Manufacturing Co., Ltd., Allis-Chamlers Company, Ingersoll-Sergeant Drill Company, Lidgerwood Manufacturing Co., Wagner Electric Manufacturing Co., Canadian Engineering Co., Ltd., and that the head office and works will be at Montreal, with branches at Toronto, Winnipeg, Vancouver, Rossland and Halifax. The new organization will operate in close relations to the American Companies represented and will manufacture machinery, identical in design and of the same high grade of material and workmanship. It assures customers that, with shops of the most modern design and equipment, and the benefit of the wide engineering experience of the American Companies the finest class of machinery will be produced. This corporation has been evolved from the Canadian Engineering Co. Ltd., which has now been merged into the larger enterprise. Officeshave been in the Coristine Building, Montreal, but larger offices are now being fitted.

The B. Greening Wire Co. Limited of Hamilton, Ontario, report a steadily growing demand for the *wire* barrel hoop in place of the old-fashioned *elm* hoop. There is such a difficulty now experienced in getting material suitable for wooden hoops that not only has the price greatly advanced but it seems impossible to get stock of suitable quality to supply the larger shops. In consequence the wire barrel hoop has come into use. The wire barrel hoop consists of a piece of No. 9 to No. 12 gauge steel wire with the ends twisted together, forming a perfect circle which is slipped down over the barrel into place without binding at any particular point; the cost is as low or lower than the wooden hoop. These hoops are now successfully used on flour, sugar, salt and apple barrels and are coming into general use on other barrels.

A new colliery company, known as the Nova Scotia Collieries, Ltd., with a capital of £200,000 divided into 100,000 preferred shares bearing 6 per cent. interest and 100,000 ordinary shares of £1 each, has been formed with London and New York capital. The company has acquired 3,840 acres, or six square miles of coal lands in Cape Breton in the Chimney Corner field, and is acquiring an additional two square miles. Options are held on 18 additional square miles which may or may not be exercised. There have been 23,500 preference shares and 30,007 ordinary shares issued to the 1st of May, and boring operations have been carried on for some time. At present one new seam, 4 feet 1 inch thick, of a good quality of bituminous coal has been found, and three seams had been previously uncovered on the outcrop. These seams measure 5 feet, 6 feet 2 inches, and 7 feet in thick-

ness, respectively. The directors of the corporation are: Major A. G. Spilsbury, Chairman, Baron Danvers, Mr. Edmund Kimber, Mr. Arthur Morgan and Mr. Ira Taylor. The local directors in Nova Scotia are: Hon. Wm. Ross, M.P. of Cape Breton, and Hon. Wm. Roche, M.P., of Halifax. The quality of the Chimney Corner coal is most excellent and the chances are favorable for this concern.

The Allis-Chalmers Company of Milwaukee advise that they have appointed Mr. James W. Lyons, manager of their newly created Power Department. Mr. Lyons was formerly associated with the Allis-Chalmers Co. as engine salesman; his department now controls the sale of reciprocating steam engines, steam turbines (entire unite including turbo-generators), condensers, gas engines, pumping engines, blowing engines, hoisting engines, and air compressors.

The A. Leschen & Sons Rope Co., St. Louis, Mo. have been compelled to seek larger quarters in New York City and have taken the large offices at 163 and 165 Washington St. where they have increased facilities for carrying a very much larger stock than in the past and opened their new and commodious offices on the morning of May 2nd. This firm manufactures all grades and kinds of rope and are the sole manufacturers of Hercules, and Patent Flattened Strand, Wire Rope.

The Macdonald Institute at the Ontario Agricultural College, Guelph, will provide a Summer School for teachers during the coming vacasion. The term will exteud from July 5th to July 29th. The classes will be under the direction of Dr. W. H. Muldrew of the Macdonald Institute, and Professor William Lochhead of the Biological Department in the Ontario Agricultural College, assisted by teachers of special fitness in the various subjects of the course. The course will be thoroughly practical, involving daily excursions, lectures and laboratory work, the preparation of Nature Study collections and courses of reading in illustration of the subjects discussed.

NEW COMPANIES.

V.I. Exploration and Development Co., Ltd.—Incorporated 27th April, 1904. Authorised capital $100,000 divided into 100,000 shares of $1 each.

Washington Mine, Limited.—Incorporated 25th April, 1904. Authorised capital $200,000 in shares of $1 each.

New Monashee Mines, Limited.—Incorporated 26 April, 1904. Authorised capital $1,000,000 in shares of $1 each.

Royal Smelting and Refining Co., Ltd.—Incorporated 6th May, 1904. Authorised capital $100,000 in shares of $10 each.

South-East Kootenay Coal and Coke Co., Ltd.—Incorporated 5th May, 1904. Authorised capital $100,000 in shares of $1 each.

Berry Creek Mining Co., Ltd.—Incorporated 16th May, 1904. Authorised capital $150,000 in shares of $5 each.

Atlin Dredging Co., Ltd.—Incorporated 12th May, 1904 Authorised capital $25,000 in shares of $1 each.

Minnie Mining Co., Ltd.—Incorporated 13th May, 1904. Authorised capital $125,000 in shares of $1 each.

ONTARIO.

The St. Louis Reduction Co., Ltd.—Incorporated 20th April, 1904. Authorised capital $500,000 in shares of $1 each. Head office: Toronto, Ont. Provisional directors: Charles Bagot Jackes, barrister, Toronto; Robert Forbes, mining engineer, Duluth, Minn.; and George Edward Kingsley, St. Lonis, Missouri.

British American Development Co., Ltd.—Incorporated 20th April, 1904. Authorised capital $1,000,000 in shares of $1 each. Head office: Toronto, Ont. Provisional directors: James E. Haines, Brampton, Ont.; Alfred T. Haines, Cheltenham, Ont., Adam Linton, Jas. E. Carter, Wm. J. Armstrong, all of Guelph, Ont., and J. W. Cheeseworth, Toronto, Ont.

Montreal and Boston Consolidated Mining and Smelting Co., Ltd.—Incorporated 27th April, 1904; Authorised capital $7,500,000, in shares of $5.00 each. Head Office: Toronto, Ont. Provisional directors: Henry Jas. Wright, Joseph A. Thompson, John Payne, Richard Credicott, W. J. Gilchrist, all of Toronto, Ont.

Syndicate Mining Co., Ltd.—Incorporated 15th April, 1904. Authorised capital $50,000 in seares of $1.00 each. Head office: Toronto, Ont. Provisional directors: S. P. Kineon, L. E. Ziegle, George Kinsey, E. J. Gardner, of Cincinnati, Ohio, F. W. Whitaker and O. M. Bake, Hamilton, Ont., and R. C. LeVesconte, Barrister, Toronto, Ont.

St. Anthony Gold Mining Co., Ltd.—Incorporated 29th April, 1904. Authorised capital $1,000,000 in shares of $1.00 each. Head office: Ignace, Thunder Bay District, Ont. Provisional directors: Benton Hanchett, Geo. W. Eadock and Arthur Hill, Sagniaw, Michigan.

South Essex Oil and Gas Co., Ltd.—Incorporated 11th May, 1904. Authorised capital $500,000 in shares of $1.00 each. Head office: Leamington Ont. Provisional directors: John A. Auld, Amherstsburg, Ont., Darius Wigle, B. Jasperson, S. L McKay, of Kingsville, Ont., Edward Winter, H. R. Whaley, J. H. Conover and B G. Westcott of Leamington, Ont.

Detroit and Parry Sound Mining Co., Ltd.—Licensed under the laws of Ontario as an extra-provincial company 11th May, 1904. Authorized capital for Ontario $50,000. Head office: Frank H. Macpherson, Windsor Ont.

Ursa Major Co., Ltd.—Incorporated 6th May, 1904. Authorised capital $1,000,000 in shares of $1.00 each. Head office: Toronto, Ont. Provisional directors: J. G. Harris, J. A. Keyes, Robt. Forbes, Mining Engineer, Albert J. Milner, of Duluth, Minn., and Chas. B. Jackes, Barrister, Toronto, Ont.

Notice.

Chemists, metallurgists and assayers in Colorado have joined in an attempt to form an association of technical men who are interested in the chemistry of reduction processes, and an attractive introductory letter has been issued by the Committee in charge. The objects of the association are to improve and standardize methods of work, to communicate experiences and opinions on matters of chemico-metallurgical interest, and to increase the exchange of opinions and personal intercourse and knowledge.

The temporary organization proposes affiliation with the American Chemical Society and the Society of Chemical Industry (London) and also to include all persons interested in the subjects of chemistry and metallurgy west of the Mississippi river, including British Columbia and Mexico.

The secretary, pro tem, is Mr. H. C. Parmalee, of Denver, Colo., whose address is P.O. Box 1421, who would be glad to receive communications from intending members and to answer all enquiries. The REVIEW wishes the Society all good luck.

CANADIAN MINING INSTITUTE

Incorporated by Act of Parliament 1898

AIMS AND OBJECTS.

(A) To promote the Arts and Sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications.

(B) The establishment of a central reference library and a headquarters for the purpose of this organisation.

(C) To take concerted action upon such matters as effect the mining and metallurgical industries of the Dominion of Canada.

(D) To encourage and promote these industries by all lawful and honourable means.

MEMBERSHIP.

MEMBERS shall be persons engaged in the direction and operation of mines and metallurgical works mining engineers, geologists, metallurgists, or chemists, and such other persons as the Council may see fit to elect.

STUDENT MEMBERS shall include persons who are qualifying themselves for the profession of mining or metallurgical engineering, students in pure and applied science in any technical school in the Dominion, and such other persons, up to the age of 25 years, who shall be engaged as apprentices or assistants in mining, metallurgical or geological work, or who may desire to participate in the benefits of the meetings, library and publications of the Institute. Student Members shall be eligible for election as Members after the age of 25 years.

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PUBLICATIONS.

Vol. I, 1898, 66 pp., out of print.
Vol. II, 1899, 285 pp., bound red cloth.
Vol. III, 1900, 270 pp., " "
Vol. IV, 1901, 333 pp., " "
Vol. V, 1902, 700 pp., " "
Vol. VI, 1903, 600 pp., now in press.

Membership in the Canadian Mining Institute is open to everyone interested in promoting the profession and industry of mining without qualification or restrictions.

Forms of application for membership, and copies of the Journal of the Institute, etc., may be obtained upon application to

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Ontario's Mining Lands..

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite : copper in sulphide and native form ; gold, mostly in free milling quartz ; silver, native and sulphides ; zincblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1900 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe. The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc , apply to

HONORABLE E. J. DAVIS,
Commissioner of Crown Lands,

or

THOS. W. GIBSON,
Director Bureau of Mines,
Toronto, Ontario.

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Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

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PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents anuually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

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Wire specially selected for own exclusive use.
We have made many records with our Winding, Haulage and Crane Ropes.

Illustration of **Winding Rope,** 240 fms. long x 3½ circ. Galvanized Special Improved Patent Steel, Compound Make, supplied to Kenneil Collieries Bo'ness, Scot., which gave a record life of 6 years and 2 months. Shewing condition when taken off.

TELEGRAMS—"Ropery Rutherglen. A B C, A I and Lieber's Codes used.

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W. H. Thorne & Co. Ltd., Saint John, N.B.

Drummond, McCall & Co., Montreal.
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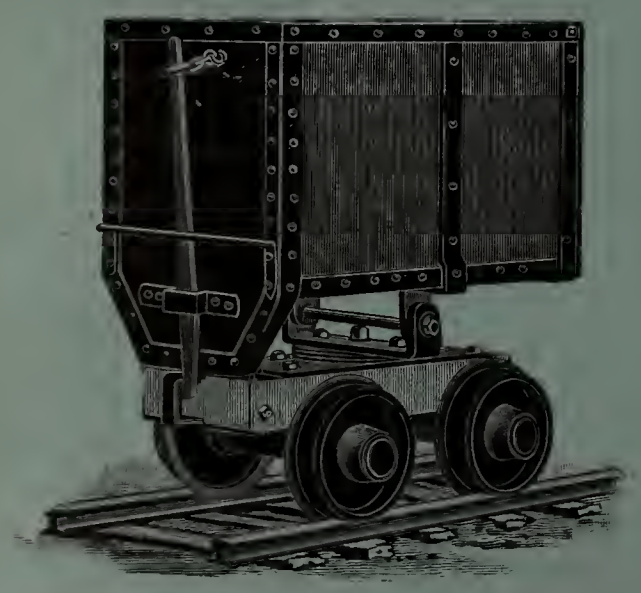

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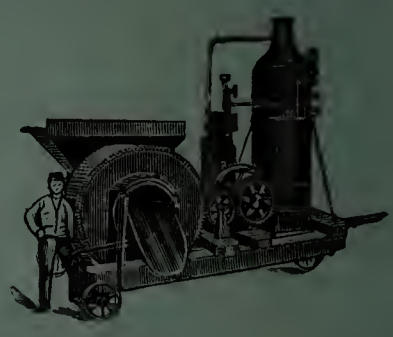

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The CANADIAN MINING REVIEW

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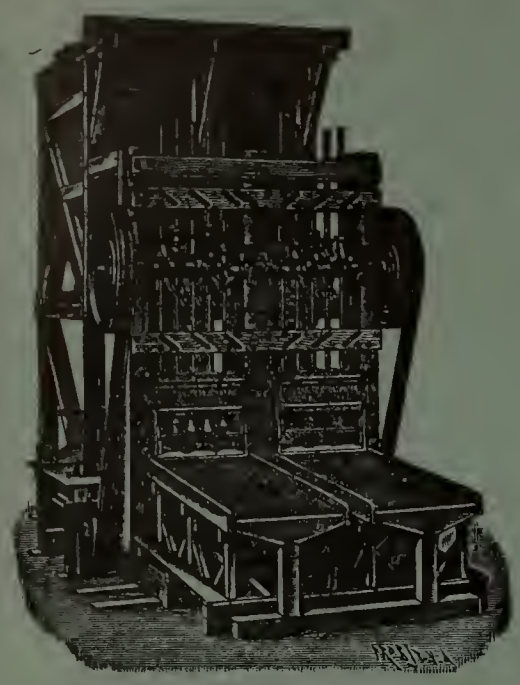

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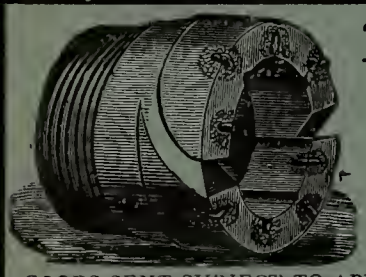

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The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

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Dominion of Canada

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be aquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee, $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be obtained within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one-half per cent on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200.

A certificate that work has been done must be obtained each year: if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior,
OTTAWA, February, 1904.

JAMES A. SMART,
Deputy of the Minister of the Interior.

DIRECTORY OF MINING ENGINEERS, CHEMISTS, ASSAYERS, ETC.

22nd YEAR OF PUBLICATION

The CANADIAN MINING REVIEW

Established 1882

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CONTENTS.

At the moment of going to press the REVIEW is advised that, the so-called Treadgold Syndicate, composed of Messrs. Treadgold, Orr-Ewing and Barwick, which, under the concession of an order in Council, claimed extraordinary privileges in the Yukon District, has withdrawn all its applications, and will confine itself in the future to the legitimate working of the claims it owns. The remonstrances attending this concession were the occasion for the appointment of the recent Royal Yukon Commission, whose report will now be of diminished interest to the miners of Dawson and vicinity.

Advices from the St. Louis Fair tell us the Mining Exhibit from Canada is something of a surprise to visitors. The Canadian Government is fortunate in the representative of the Geological Survey Department, Mr. R. L. Broadbent, who is in charge of the Government exhibit, and who is thoroughly competent.

The display from British Columbia will do an immense amount of good to that province; the exhibits from the other provinces are very attractive but are not so complete. One of Ontario's interesting and unique exhibits is the collection of black marble samples which came from the two localities of Madoc, in Hastings County, and Cornwall, in Glengarry County.

The forestry exhibit is also remarkably good, the giant trees from British Columbia attracting much attention. Industrially, Canada does not make a good exhibit.

The re-organization of the various "Soo" enterprises is a matter of congratulation to all concerned, and one fraught with important consequences for Canadians in general and Ontarians in particular. The Dominion and Provincial Governments have both taken a hand in the work of resuscitation. The former by the "dumping" clause which is specially designed to protect the steel industry, and the latter by guaranteeing the interest on the bonds. It now remains to be seen what the new Company will do. The available Capital, $4,000,000 is small and only gives $1,000,000 actual cash, the balance being made up of liquid assets, $1,500,000, and first mortgage bonds, $1,500,000. If, as is stated in the press, it is intended to revive all the various industries, it is difficult to see how the working capital can be considered adequate. If a judicious selection of some of them is made, the Lake Superior Corporation may do much to redeem the failure of its predecessor.

The granting of licenses to original locators on blocks 4934 and 4935 East Kootenay, carries an important issue one stage further, in that it determines the attitude of the British Columbia Government in the matter. These are the blocks which were, by order in Council, ceded to the C. P. R. two years ago as a grant for constructing the Columbia and Western Railway, but were afterwards recovered by the Government in consequence of a dispute which caused the resignation of two ministers, and the passing of what may be called "remedial legislation." The value of these lands is in the coal deposits which they are known to contain, and the oil which it is hoped will be found in the southerly or "Flathead Block." As to the former it will be wanted some day, but certainly not within the next 100 years. The mines already opened up at the Crow's Nest Pass and Blairmore

districts will have difficulty in finding a market for half their capacity of production and they are more accessible than the "Flathead." As to oil, that is entirely problematical with a leaning to the improbable. Meanwhile the principal result of granting the licenses will be to start a vigorous crop of litigation as to titles, since there are literally thousands of claimants and the bulk of the area is staked over several times.

The Sydney Strike and the Iron Industry.

The strike at Sydney, C.B., of the employees of the Dominion Iron & Steel Company, has resulted in the management closing down all the works for "an indefinite period." From the language which has been used by Mr. Frederick Nichols, the Vice-President of the Company, this "indefinite" period means, approximately, from six to seven months, or a length of time sufficient to complete the smaller rail mill and the finishing mill, which were building at the beginning of the strike. Many well-informed men are of the opinion that the strike will be of short duration and will be ended by the submission of the strikers, but if the programme indicated by Mr. Nichols, and said to have been approved by President Plummer, is carried out, the tables will probably be turned on the strikers for some time, or until the Steel Company has completed such portion of its plant as is necessary to supply the market it has at present.

At the beginning of June the only product the works were producing to sell was steel billets, for which the price has ruled so low (for nearly a year now) that the shipments made yielded little, or no, profit. At the beginning of the year, when the new Director of Works took charge, he did not view with favor the large rolling mill formerly determined upon, and a smaller mill, with the bulk of its trains adapted to the rolling of merchantable bar iron, of circular and rectangular sections, was decided upon; to include, however, rolls for certain shapes and sections of rails for which the home market furnished a demand at profitable figures.

The announcement of the Finance Minister, in his Budget Speech, of contemplated duties on rails to prevent the surplusage of foreign nations being dumped into Canada, may, however, be sufficient ground for reconsidering the plant determined upon at the beginning of the year. The future needs of the Grand Trunk Pacific, combined with the heavy protection afforded by a bounty of $7.00 per ton and a possible 15% ad. val. duty, would give to Canadian rails not only a steady market for several years, but an advantage of something like $10 per ton over any imported rails. It is well known that the Pennsylvania Steel Company and the United States Steel Company have quoted to our Canadian railways this year, prices for rails delivered in Montreal, ranging from $20.50 to $22.50 per ton, whereas the price for the same rails in the United States remains at about $28 per ton.

On a 15% import duty the above prices would average to the consumer, say, $24.75, and with the bounty would throw him into the hands of Canadian makers, of which there are only two possible in sight—the Dominion Iron & Steel Company, who might be in the field at the end, say, of 1904, and the Lake Superior Company at Sault Ste. Marie, which could be able to deliver rails within thirty days, provided it can purchase its ore or billets in the U.S.; its supply of native ore is not certain and is likely to be most irregular.

Such conditions, known and thoroughly appreciated by the Directors of the Dominion Iron & Steel Company, would be quite sufficient inducement for them to disregard, if not welcome, the present strike. The strike will give them time to set their house in order for a four or five years steady market for heavy rails, and also time to complete the equipment for turning out bar and rod iron.

The REVIEW wishes it could take the same hopeful view of the future of the reconstructed Lake Superior Company, which has both its rail mill and also the furnace plant in order, but which has no definite and assured *native* supply of raw materials. Some money, and more time, is required to fully ascertain what quantity of suitable ore can be depended upon from the Josephine and Helen mines, and from the other possible deposits of that iron range in Ontario. On the directorate of the Lake Superior Company are one or two men (Canadians) who are no rash boomsters but men of experience and sound judgment in the iron trade, and who may be depended upon for energy and to make the best of every opportunity that is afforded. Were it not for the legacy of litigation which is assured to follow the reconstruction, and the uncertainty as to the supply of ore from its Ontario iron mines, the Lake Superior Company might be regarded as an anchor to the Canadian Iron Trade; the REVIEW, however, hopes that the adverse information which it has is misleading, but proof is yet required.

As to the Western country, the Canadian Pacific Railway, owners of the best ore on the Pacific coast (in the shape of the Kitchener properties) wisely determines that the trade there does not demand present exploitation of the resources which it holds; nor will it, in all probability, for ten years to come.

The collapse of the unwieldy aggregation at the Sault brought great disaster to the locality, but greater yet to the shareholders in the States, and the strike at Sydney will cause losses to many Canadians. The closing of the works at Sydney means also the closure of the mines on Bell Island, Newfoundland, the closure of the limestone quarries at Marble Mountain and Georges River, C.B., and also the suspension of work by the subsidiary concern known as the Dominion Tar & Chemical Co. In all, some 4,000 people are thrown out of employment, and the Island of Cape Breton with the mainland of Nova Scotia will indirectly feel the loss of business and of the money which these industries put into circulation.

As to the possible involvement of the Dominion Coal Co. through the Provincial Workman's Association—we do not regard such an event as probable. The P.W.A. has already levied on its members an assessment of $100,000 for the relief of the strikers, but experience has shown how far a relief fund will go. Moreover, a sympathetic strike among

the coal miners would diminish tremendously the chances of collecting any assessments imposed by the P.W.A.

Late advices from President Plummer at Sydney indicate that sufficient labor is obtainable to discharge the ore steamers lying at the docks and to do the necessary yard work about the plant. A despatch also advises that certain departments of the works are ready to start whenever sufficient labor is obtained; it is significant that many additional workmen are being enrolled on the pay list each day.

The D. I. & S. Company has had troubles enough in its short career to dishearten several managers and to stagger financial men; but it has never had as experienced and capable men at the heads of its technical and financial departments as at present. Leaving entirely to one side the question of the possibility of large profits, there is no doubt in the mind of the REVIEW that the corporation can live and pay its fixed charges in spite of this last strike; with the great measure of protection already alluded to, it should be able to distribute something to shareholders also.

The Northport Smelter.

The readers of the REVIEW may not have forgotten the trip to England which was taken by Messrs. Gooderham and Blackstock something like three years ago, when one or two of the well-informed newspapers hinted at a *rapprochement* between the War Eagle and the Le Roi. We speak whereof we know in saying that the present rumors of consolidation in Rossland are due to the continued efforts of the Vice-President of the Centre Star Corporation. We also believe we are within the truth in saying that, at the moment of writing, the question of merging has not come before the Boards of any of the three Companies officially.

The REVIEW therefore thinks the time opportune to call Messrs. Blackstock and Kirby's attention to facts which they *know* very well, but which they may perhaps overlook. These facts relate to the unwisdom of sending the raw minerals of B.C. across the line to be smelted in furnaces which draw their fuel supply also from B.C., when there are Canadian stacks which can, and do, smelt for less money than is possible at Northport.

The coke furnished costs more by reason of a longer haul and a duty, the labor rates are higher and the labor troubles infinitely worse. The difficulties which the Northport plant have already had with the labor question must have cost fully half a million dollars. In addition there have been fyled many suits at law involving the entire water supply of the smelter.

Compared with the Kootenay smelters, Northport has to burn coal to furnish its power, Trail and Nelson both have electric power, and the cost per H.P. used is much less for electric power than for the steam power used at Northport. Briefly, let the gentlemen in charge of the possible merger consider that here is a case of a Canadian mine, employing Canadian labor, sending its ore across the boundary line to a smelter which it owns, where all costs are higher, where the labor question is more difficult, and where only American labor can be employed.

The REVIEW submits that, on commercial grounds alone, it is advisable to drop a policy the operation of which is more expensive than its alternative.

A Rossland Merger.

In our issue for May we commented upon the alleged condition of affairs at the Le Roi as disclosed by telegraphic despatches to the home office from Mr. J. H. MacKenzie and Mr. A. J. McMillan. The following weeks were full of developments and announcements; Mr. S. F. Parrish resigned his position as General Manager, the Managing Director, Mr. A. J. McMillan, made no new appointment to the vacant office, but engaged Mr. J. H. MacKenzie of the San Francisco firm of MacKenzie and Bradley, Consulting Engineers, on a temporary appointment; the concentration of the low grade ore was recommended; a lease of the "O-K" stamp mill was obtained, and Mr. Thos. Mitchell, the builder of several silver-lead concentrators in the Slocan, was engaged as concentration expert. Incidentally Mr. McMillan intimated that the Northport Smelter might be closed after the reserve ore, amounting to between 30,000 and 40,000 tons, had been smelted. The Managing Director also stated that the Le Roi was then putting out about 160 tons a day, but admitted that permanent smelting required large deliveries of custom ore to make economic fluxing possible, and intimated that relief could only come from the use of Boundary ores, as the supply of other fluxing ores would be too irregular for permanent and continuous smelting. He did not say anything about the resources of the Snowshoe mine in the Boundary, for which he is to be commended.

Meanwhile Mr. S. F. Parrish is too ill to tell his side of the story or to transact any business whatever, and the despicable slur of the London *Financial Times* that this illness is of "a diplomatic character" is not only a plain falsehood but intensifies the local and general Canadian disgust for English corporations and English press comment. Mr. Parrish's local popularity is unlimited, and his personal reputation for integrity unblemished. Mr. Robbins, the assayer at the mine, denies any fault in the assaying, and until Mr. Parrish's health permits him to make a statement the story cannot be closed.

Immediately upon this *melange* came the rumor of a merger for the Le Roi Company with the Centre Star and Consolidated War Eagle corporations. Mr. T. G. Blackstock appears opportunely in Rossland and is in conference with Mr. McMillan; Mr. Kirby and Mr. McMillan jointly spend much time in going over the Rossland Power Company's concentrating mill.

It is to be hoped that all these observed facts will bear fruit in the shape of a combination of interests and of management, although it is difficult to perceive any financial basis which will be satisfactory to the three corporations. The Le Roi Mining Company has a capital of £1,000,000

stg., all issued and fully paid, and a floating debt of about $130,000, fully covered by the ore in the bins at Northport. The Centre Star has a capital of $3,500,000 with a surplus of cash in hand. The War Eagle Consolidated Mining and Development Company has an issued capital of $1,750,000, and a liability of over $200,000.

The last making up price of Le Roi shares was 15s, or 15% of par, Centre Star has ruled about 26c or 26%, and War Eagle 12c or 12% of par. The respective *market* values of the three properties therefore are, approximately :

Le Roi	$ 750,000
Centre Star	910,000
War Eagle.....	210,000
Total present market value of...	$1,870,000

The Le Roi claims a valuation of $1,000,000 for its smelting plant at Northport, but we fancy no informed and dispassionate accountant would allow much, if anything, for the smelter as an *asset* of the Le Roi Company. From the day it was started to the present time, there has been a continuous story of waste, incompetency, dishonesty, and expense; a story of legal and labor warfare, and an inheritance of adverse decisions and disputed judgments. It is equally well known that the best men of previous managements have advised the Board of Directors to close the smelter as being a voracious consumer of the profits the mine could make.

If any merging agreement should be found to be feasible, which we admit is yet a doubtful matter, the control will probably be put in the hands of the Centre Star people. We need not say that such a consummation would be most acceptable to the people of Rossland, and to Canadians generally. The management of Pacific Coast properties from the Atlantic seaboard is always difficult and expensive; the management of Red Mountain mines from London, 5,000 to 6,000 miles distant, is folly.

CORRESPONDENCE.

Incompetent Management.

To The Editor.

Sir:—

Having regard to the very pessimistic way in which mining investors now look on Canadian properties, it may not be out of place to record some observations of several "failures" which have assisted them to that opinion.

The particular section which the writer has in view runs for about 90 miles East from Sault Ste. Marie along the line of the C. P. R. and north along the line of the Algoma Central Railway; it will be noted that I do not include the Sudbury field where the only important mining of the District is done.

Concerning the former Consolidated Lake Superior Co. you do not need any observations of mine; the papers of the U. S. and Canada have supplied the public with sufficient details. Numerous links in that long chain, both large and small, were weak and broke in consequence of the weight of the whole chain. Other links were sound and strong in themselves, but useless when included in a chain with weak links.

Probably the next largest expenditure was made at the Bruce Mines, where there was an exception to the general conditions which obtain about the re-opening of old mines. The owners and shareholders in this case were "seasoned" mining men who ceased operations *not* because of lack of funds or disappointment with the property, but because of a disagreement, or disagreements, between the shareholders and the Directors. The Bruce Copper Mines, Ltd. is a close corporation, owned in England, with no shareholders on this side; the closure of operations therefore affects this country only in *morale*..

Suspension of the Rock Lake Mining Co., Ltd. was due primarily to insufficiency of funds, and perhaps also to inexperienced management. The Directors do not appear to have exercised unusual business acumen, and the result is a suspension of active operations.

To generalize from the above cases we may say that, money has been raised from men who have made their money in other lines of business, and that this fact is one of the causes of the resulting failure. While such men deserve credit for their enterprise in selecting such a venture, they do not deserve any credit for repeating the very common error of considering the promoter the best man to continue the actual management of the property.

In many cases the employment of competent engineers in the place of promoters would have given if not a measure of success at least a diminished expenditure; in fact in many cases it would have resulted in the expenditure of no money at all.

Your readers must, each one of them, remember many cases where the employment of an engineer to examine, or to manage, has been considered far too extravagant, and therefore the company has expended thousands of dollars to no useful purpose, but with the result of giving another "black eye" to Canada.

A.

Sault Ste. Marie, June 10th, 1904.

The Dominion Iron and Coal Properties.

To The Editor.

Sir:—

Anyone who has followed your articles on these properties, spread over the last four years must have been prepared for the denouement which has been reached. By common report the practical collapse of the Iron and Steel enterprise is due to two causes, incompetency and stock-jobbing. As to the first cause there is now no doubt that the inception of the Company was characterized by that reckless extravagance which has too often marked the launching of legitimate industrial enterprises but which is the unerring precursor of their doom. No sense of the requirements of the enterprise, no adaptation of means to end, no conception of the possibilities of the market, no intelligent test of the materials available for manipulation—these were some of the deficiencies of the pioneers of Canada's "greatest industry." Given cheap coal and cheap ore, both in abundance, they jumped to conclusions which have been falsified by experience, that they could manufacture the cheapest and best steel in the world, and that the world was waiting to take all they could produce. As to the cheapness, the original estimate of $5 for pig requires to be doubled, as to the quality, the "cheap" ore requires a higher grade to mix in large quantities, and as to market, your original prediction that only in times of inflated trade and high priced material abroad would Sydney be able to sell in foreign markets, has been fulfilled to the letter. To-day the Company looks—as it will always have to look—to the home demand—and even that is beyond its grasp unless the cost of production can be greatly reduced. The Company has no

reason to complain of the generous treatment it has received at the hands of the Canadian Government, and the recent statesmanlike provision introduced into Mr. Fielding's budget, to prevent dumping at slaughter rates, disposes of the last hindrance to a successful home trade so far as legislation can assist.

That the Steel Company has reached a crisis in its history must be admitted, and no better opportunity could have occurred to put its house in order. For more than a year, in fact ever since Mr. Plummer took charge of its financial affairs, voluntary liquidation has been advised and it is believed that the President favoured this course from the first. This suggestion was discarded for various reasons, chiefly that no basis could be found which would give any approach to the existing market quotations for the various securities of the concern. Still it is greatly to be regretted that the course suggested was not adopted since it would have relieved the financial strain which has become intolerable. The same objection cannot now be urged. Iron Common has fallen from 78 to 7, Preferred from 60 to 22, and bonds from 100 to 55. In view of present developments the former is practically wiped out and need not be taken into account. Re-organization on the basis of Bonds at 50, Preferred at 20, and Common entitled to subscribe for new stock at 25 would be about fair and in this way, if $5,000,000 were raised, there would be sufficient in the Treasury to pay the pressing liabilities, finish construction and provide working Capital. The strictest economy would have to be practised, a supply of non-phosphoric ore secured, and the Canadian market assiduously cultivated. Under these conditions a moderate result might be attained and, as the country develops, trade would expand and, ultimately, steel making at Sydney become a permanent industry. The unqualified success of the Nova Scotia Steel Co., shows what can be accomplished along conservative lines. It has proceeded by slow and steady steps from a small venture to a gigantic enterprise, but the management has been practical and the policy wise. Trade has been sought and increased little by little, and quality has been the first consideration. This is the way of the Old World, and of the New, and it will have to be followed by the Dominion Steel Company if it ever rises from the ashes of its humiliation.

Dominion Coal is in a different case. Its value and possibilities have never been doubted and in spite of over-capitalization and excessive expenditure it will pull through if the present policy is maintained. Coal is slowly but surely emerging from a dangerous impasse; the modest and eminently practical development at Big Glace Bay furnishes a remarkable contrast to the reckless and ridiculous extravagance of Dominion No. 2, that final and perpetual monument of blind incompetency. I do not hesitate to say that this $3,000,000 mine if charged with the modest interest of 6% upon Capital will never produce coal within 20 cents a ton of Dominion No. 1, Caledonia, Reserve or Big Glace Bay. The latter will be fully equipped for one tenth of the outlay.

On this economic development Mr. Ross and his staff are to be congratulated. The policy of establishing a deep mine like Dominion No. 2 where there is slope coal for the next fifty years could never be seen and there is little, doubt that the lines on which the concern is now being worked—the old lines—will lead towards the production of 80 cent coal, which so cheered the Directors under the old regime in 1896–7.

Still there are breakers ahead and the good ship will need careful handling. If the steel works should not soon resume coal will lose its largest, best and most convenient customer. It must never be forgotten that Mr. Whitney started steel to help coal to a constant market. Trade outside has been good and prices inflated. There is a turn in the tide, prices are falling, production will be less this year than last, every Colliery Company showing a decrease. At the beginning of the last financial year there was predicted a sale of 3,000,000 tons by the Dominion Coal Company and a profit of 65 cents a ton. This year it is doubtful if the tonnage will exceed the same estimate, and the profit will certainly be less, probably $1,500,000. It is rumored that Mr. Ross has made arrangements in London for floating bonds to replace the present high-priced bonds and preference stock and that by the transaction something like $200,000 a year will be saved. This is good news, and, if true, will be of material assistance. With good management Dominion Coal has nothing to fear from any source, whether competitive or otherwise, but in this case good management involves passing the dividend altogether this year, more modest expectations in the future, and an absolute cessation of capital expenditure. If this course is pursued there is no reason why common stock should not be permanently maintained at about 60 which on this class of investment would yield a reasonable return.

* * *

MONTREAL, June 18th, 1904.

The Lead Bounty.

THE REVIEW is in receipt of the following telegram:—

"CANADIAN PACIFIC RAILWAY COMPANY'S TELEGRAPH.

From PAYNE MINE, B.C., via SANDON,

June 27, 1904.

TO EDITOR,

CANADIAN MINING REVIEW,

Ottawa Ont.

In the interest of mine owners and justification of smelters please withdraw your April and May editorials claiming that smelters directly or indirectly obtain part of lead bounty. This statement positively cannot be substantiated, and may cause trouble. Explanatory letter for publication mailed to-day.

ALFRED C. GARDÉ,

President Associated Silver-Lead Miners of B.C."

The REVIEW desires, above all other things, to present truth and facts *only* to its readers; it, therefore, willingly publishes the above telegram and sincerely regrets the non-receipt of the explanatory letter before going to press. We have held the last form open to the last minute in the hope that we could print Mr. Gardé's letter. It will appear in our July issue.

In our April issue appeared an editorial on "B.C. and the Lead Bounty," which was printed as an authoritative and credible article as it came from one who is not only familiar with the subject but who is himself personally interested in the Silver-Lead industry. A private letter remonstrating against the assertion that the smelters ever received any portion of the bounty was communicated to the writer, who asserted again the truth of his statements, which appeared in our May issue.

We hope to present, fully, all the facts connected with the present bounty in our next issue when Mr. Gardé's letter will, we hope, have arrived.

EDITOR, MINING REVIEW.

During the month there have been heard before Mr. Justice Martin, sitting at Nelson, B. C., six test suits for damages against the Crow's Nest Pass Coal Company. These six cases were selected from a large number fyled in consequence of the disastrous explosion which occured on the 22nd of May 1902. The hearing has been a long one, and a number of expert witnesses were examined, amongst others, the REVIEW's esteemed correspondent in B. C., Mr. Wm. Blakemore.

Mica Deposits.

By Fritz Cirkel, M. E.,

(*Continued from May Issue.*)

India ranks foremost amongst the mica producing countries of the world. It employs more persons in this class of mining than any other, while the area covered by mica deposits is the largest so far known. The mines have supplied most of the world's market since the application of mica in electricity.

In the year 1902 (Rept. Insp. of mines Calcutta 1902) there were employed in mica mining 9500 persons, while the production and sales in the same year were 1685 tons valued at $507,770. This output is supposed to come from over 200 mines, which means a production of only 8 tons per mine. From this fact it is evident that, mining operations are not carried on on a substantial basis; most of the mica deposits are of a pockety nature. As a whole their occurrence is very irregular, and taking also the shortness of the season into consideration —work is only conducted during the dry months—it is clear that mining resembles a perpetual shifting of operations from one place to another. However, in spite of all these drawbacks, the cheapness of labor and the richness of the individual deposits makes mining profitable, and if the present slow native methods of mining were replaced by those of Europe or America, there is no doubt that at least half of the labor employed could be dispensed with.

Mica Mining in India has its history. We hear that the Hindus, who use the better qualities of mica for ornamental purposes, as for banners, toys, tapestry, flowers etc. have been mining mica for centuries. The mines near Patna & Delhi are the oldest in the country. Dr. P. Breton visited these mines in 1826 and found as many as 5000 natives working in the different mines. In 1849 Dr. McClelland records an output of 800,000 lbs. and the first exports of mica were made in 1863, from Bengal, of about 7500 lbs. From this time the exports have steadily increased, and it was not until the use of mica in electricity, that the mining of mica assumed such large proportions. According to A. Melvyn Smith* the mines in Bengal are situated between 85° to 86° 30′ east longitude and 24° 25′ to 25° north latitude; they are distributed over a large series of parallel ranges of low hills, some 400 ft. above surrounding country and about 1200 ft. above sea level. They form the boundary between the Hazaribagh district on the south and the Gaya and Monghyr districts on the north, being part of the Bengal Presidency—India. The direction of these ranges is east-west.—

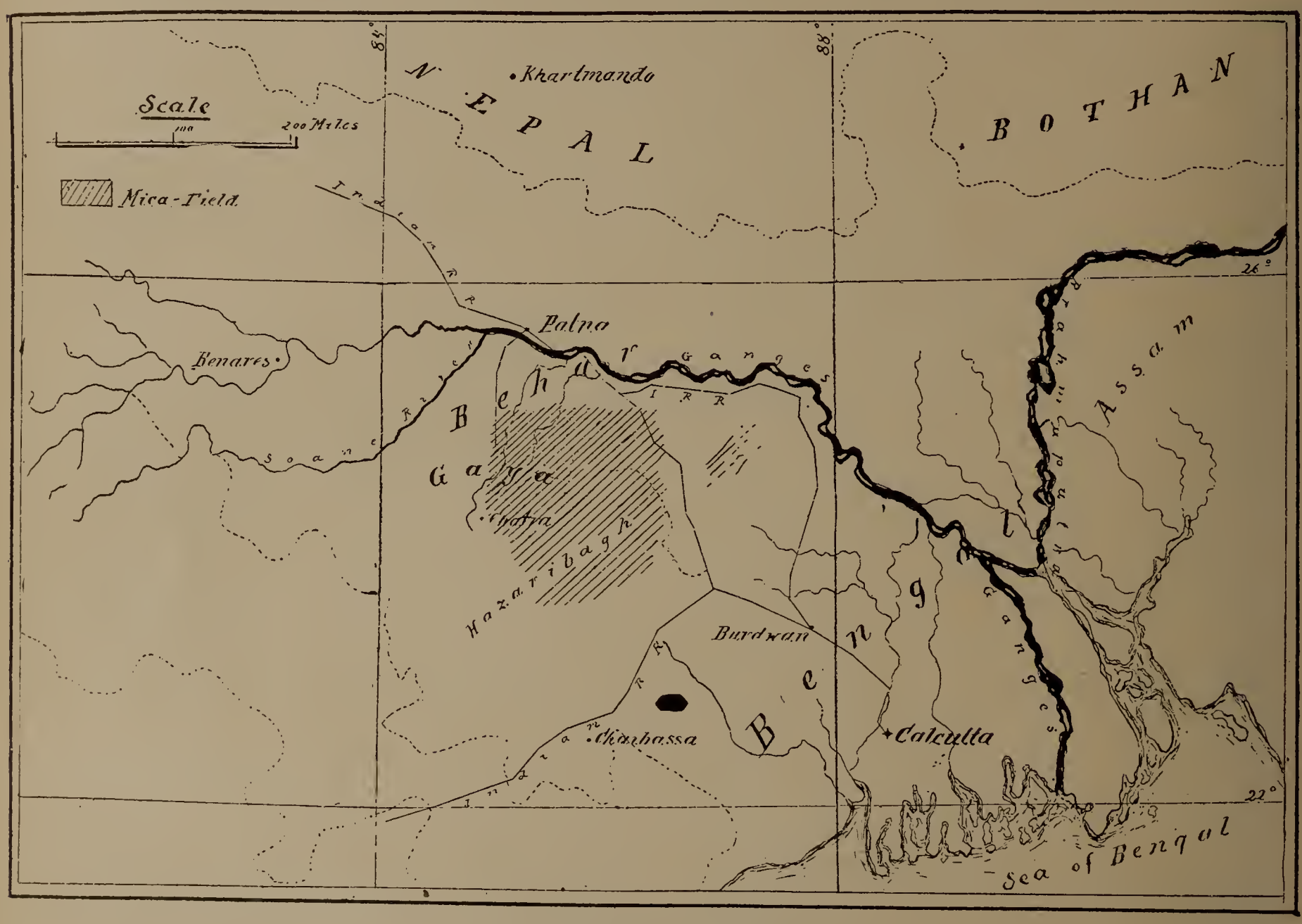


Fig. 6.—The Mica Field in Bengal, India.

The mines at present of most importance are all situated in the districts of Hazaribagh and Gaya in Behar. The mineral is also found in certain parts of Manbhoem, but all attempts to work these mines to advantage have failed. The principal mines in the Hazaribagh district are Dumcho Gharanchi, Bochagta, Salboya and Kadama, most of these mines are situated in the Koderma Government estate, both inside and outside the Government reserve forests, the rest being scattered through other parts of the pargana of Kharakdiha. In the Hazaribagh district, Province of Bengal, there were employed in 1902

*Institution of Mining and Metallurgy 1898. P. 168.

6234 persons in 61 mines, producing 768 tons of mica, 628 tons being mined by one company. In the districts of Nellore, North Arcot and Nilgris in the Province of Madras, there were, in 1902, 69 mines in operation, employing 2965 persons and producing 228 tons of mica. In Gaya the mines worked are Singur, Vita, Chatkari, Bind, Govindpore and Korarama. The government leases out land at a fixed rate of 50 rupees per acre, while private lands are leased by arrangement. In the beginning of 1902 the Madras Board of Revenue amended the law* for mica mining in the Nellore district to conform to the general mining rules of the Government of India. This action was made necessary by the fact, that speculators had obtained mining leases, which they had no intention of working and held for merely speculative purposes to the detriment of the genuine operators of the district. With each application for mining leases a deposit of 500 rupees must be made, or such sums as the Government may determine at its discretion.

As to the geology of the country, in the Hazaribagh district, large tracts of gneiss grading into mica schist can be noticed. We find also in immediate contact with the mica deposit tourmaline schists, hornblende rocks, quartzites with intrusive dikes of a fine grained diorite. The hornblende rocks resemble the diorite, and it is not uncommon to find a mica deposit between the two rocks. The mica met with in the schists is of the muscovite variety, while also black mica (biotite) and a red mica (lepidolite) is found. The mica schists are highly schistose in breaking up into thin laminae and consist principally of small mica sheets cemented together with an admixture of feldspar and quartz. It is this rock, that is generally mined for mica and yields the mica sheets of commerce. The gneisses are

FIG. 7.—Mica vein in mica schist, Hazaribagh, India.

classed in Indian geology as among the younger members of the Archaean formation. They have nearly an east and west strike and underlie to the north at an angle of about 75°.

The mica of commerce occurs almost exclusively in pegmatite veins, running with the bedding of the schists from east to west, and varying in width from a few inches up to 20 ft. The country rock is often faulted or thrown out of its normal strike, the veins are subjected to the same faulting and frequently at the point of faulting so called cross-courses of great width have been formed.

The pegmatite veins consist of amorphous masses of quartz, large crystals of orthoclase feldspar and crystals or books of muscovite mica. Generally speaking their contents in mica and the quality of the same depends to a large degree upon the nature of the adjacent rock. We find the richest and the best mica, where the including rock consists of mica schists (see fig 7). Near to the quartzite the main constituent of the vein is quartz, while little mica and feldspar generally is met with (see fig 8). Where the adjacent rock is highly feldspathic, feldspar crystals of a pink color predominate in the lode, while the occurrence of mica is insignificont (fig 9). These facts are very important for the miner and prospector, inasmuch as one can discriminate between rich and poor mica lodes.

In addition to the above constituents of the pegmatite veins many accessory minerals are met with like tourmaline, garnet and columbite. The tourmaline is at times largely developed, near to the tourmaline schisto large massive crystals of black tourmaline are numerous in the vein, occasionally crystals of tourmaline penetrate the mica books across the laminae and render the latter unfit for use.

FIG. 8.—Mica vein in quartzite, Hazaribagh, India.

The native mines are of the most original and primitive character. No system of any kind being followed, the deposits are simply exploited in the simplest way. There is no machinery of any kind. Open cuts along the outcrops of the veins, where mica crystals are found, change with cross cuts at right angles through the vein formation. These cuts have a depth of from 20 to 50 feet and as the sides, on account of the decomposed nature of the veins near the surface, are very dangerous no timber of any kind being used, accidents are very frequent, and the miners are buried often beneath the fallen sides of the vein. In an exceptionally rich deposit, the work of exploitation differs somewhat from the above; the vein is followed to greater depth—up to 200 feet sometimes, by inclines—in a zig-zag form. Long rows of native women are placed on these inclines for the lifting of the mined mica to the surface or for draining the pits. These

*Mineral Ind. 1902. P. 458.

women are placed near one another in two rows from the water level to the surface. They hand baskets filled with mica to one another, or pitchers filled with water up to the surface; the full receptacles are handed up one line and the empties the other. As many as seventy women are sometimes placed in these zig-zag inclines to remove the water or rock from the bottom of the mine; the vertical depth however does not exceed 35 feet. The decomposition of the vein or adjacent rock very often goes down two hundred feet or more, and it is here that the largest operations are carried on. In order to ventilate the inclines and draw out the mica waste material, perpendicular shafts of 2 feet in diameter are put in. Sometimes as many as 30 of these circular shafts can be counted along the strike of the vein and within a few feet from each other. Work is conducted only in the dry months from November to May. The miners are a local tribe called the "Bandathis"; men, women and children are all working at the mine, when they have no agricultural work in the field. As soon as the rainy season commences they return to their work in the field. Work is conducted only during the day beginning at 8 a.m. and is ended at dusk. No explosives of any kind are used and, where the vein is hard but sufficiently rich to pay for the labor, large fires are kindled against the face of the lode, and when the walls are sufficiently heated, water is thrown on to it; this sudden cooling causes the rock to shrink and crack. Wedges of soft iron are then driven into these cracks and in this way large boulders are detached. These tools are manufactured in a primitive way from the magnetite ores commonly found in the vicinity of the mines. The exposed crystals are chiseled out, taken to the surface in the manner above described, and split into sheets of about one eighth of an inch in thickness. All the rough edges are trimmed off by means of a sharp sickle, called "hasawah,"

FIG. 9.—Mica vein in gneiss, Hazaribagh, India.

and then sorted according to color or size. The sheets are in some cases very large, 24 in. by 18 in.; in the Hakuri mine, Nellore district, Machas, plates 60 in. by 40 in. have been obtained. Although in the last few years Europeans have taken up the mica industry mining, with a few exceptions, is conducted on purely native methods as above described. In the majority of the mines the same slow and wasteful system, as practised by the natives for over a hundred years, is still in vogue. As mentioned above, work in the mines is suspended while the heavy rains last, and this interval is used exclusively for prospecting purposes. Men are sent out to search for likely looking outcrops of mica. The mica shists being softer than the other members of rock formation, are eroded into valleys—the quartzose beds making the ridges of hills, and a certain amount of humus from the adjacent hills covers the valleys. After exceptionally heavy rains the surface deposits are washed off and with it the decomposed feldspar of the pegmatite veins, leaving exposed tufts of partially decomposed mica. The natives call these tufts "foo-foo" and believe that they grow during the rains, as they cannot account for their exposure at the surface after heavy rains, where there was nothing to be seen before the rain. Having discovered several of these "foo-foo" spots, these are marked for mining operations as soon as the dry season begins. Parties, made up of men, women and children are set to work on these outcrops and the books of mica dug out, packed in loads of about 30 pounds and brought in at dusk to the central store. Here skilled workmen are seated on the floor, trimming the mica coming from the different diggings and mines. Before each man is a stout peg, driven firmly into the ground and protruding about 18 inches. The mica crystals are split by means of sharp sickles into plates of one eighth of an inch in thickness, the point of the knife being used for opening these sheets. Imperfect laminae are peeled off the plates till both surfaces show a clean even face. The plate is drawn against the side of the peg and the sickle drawn downwards to trim off the jagged ends and irregularities along the edge of the mica sheets. After trimming, the plates are sorted for the European market, England and the United States being the chief buyers. The sheets are sorted according to quality, four kinds being recognized by the dealers: 1 ruby mica, hard and tough; 2 white transparent mica; 3 discoloured and smoked; black mica and flawed. If 8 represents the value of ruby mica, 4 would be paid for white, 2 for discoloured, and 1 for black and flawed sheets of equal size. The sizing is as follows:

No. 1	Sheets measuring from	36	to	50	square inches.
No. 2	" " "	24	to	36	"
No. 3	" " "	16	to	24	"
No. 4	" " "	10	to	16	"
No. 5	" " "	6	to	10	"
No. 6	" " "	4	to	6	"

Prices for above qualities in London are

	s	d
Best Ruby No. 1 per pound.....	6	8
" No. 2 "	4	0
" No. 3 "	2	0
" No. 4 "	1	0
" No. 5 "	0	4
" No. 6 "	0	2

The sheets are trimmed irregularly into any shape they will take, to clear them of flaws. For square, rectangular, or diamond shaped sheets extra prices are wanted. The sheets are packed into boxes of 100 lbs. and transported on carts to the nearest railway station. The distance of the mines from the railways varies between 30 and 140 miles. From thence it goes to Calcutta and is shipped to London or New York.

As to the quantity of mica available in India there is no doubt that the pegmatite veins are numerous, and compared with those of other countries of large size, while the quantity of mica in some places is very abundant. Melvyn Smith, who visited a great many mines in the northern part of India in 1898, reports that some of the mica deposits are of a very large extent. But the method of working these

mines is wasteful in the extreme and fully 90% of the mica mined is injured and rendered unfit for use. Whatever the statements regarding the richness of the deposits are, there appears to be no question that before long, modern methods of mining must be adopted, in order to make mining more profitable. Wages are very low; women get 3 pence a day, while good natives work for 4 pence. A first class native foreman—and only such can be employed under the circumstances—receives from 8 to 10 pence per day. On account of the absence of any machinery, it is difficult to follow the deposits beyond 100 feet in depth; many a mine has been abandoned, which shows at the bottom immensely rich mica deposits. There cannot be the slightest doubt that, with the introduction of modern mining methods, the cost of production will be materially reduced, the waste of mica will be much less, a better quality will be secured, while the life of a mine is prolonged until the complete exhaustion of the deposits. At present only the decomposed or partially decomposed parts of a vein are mined and it is evident that the mica at the same time must have undergone a certain partial decomposition. Mining towards the depth in the hard vein material would yield hard and no decomposed mica and in this wav would increase the efficiency of the mine, both as to quality and quantity. Associated with the ruby mica, is biotite or black mica, which is used in powdered form by the Hindus and Mohammedans as efficacious in cases of dysentery.

Some interesting mineralogical features are often observed in the India mica. The sheets are at times queerly marked, in places one half of each sheet will be muscovite and the other half biotite, the line of division between the two colors being a perfectly straight line, while there is no other apparent change beyond the color in the uniformity of the sheet. Other plates again are chequered in black lines, the lines being due to magnetite. Again dentritic inclusions of quartz between the laminae may be found. Of course all these defects have an influence upon prices paid. The most valued colors are pure ruby, amber, light green and transparent white. There is also a silver white color, which the natives prize for ornamental inlaid work.

II. Phlogopite.

The occurrence of workable phlogopite deposits appears to be confined solely to Canada and more especially to the country near Ottawa and to the townships of Burgess and Lanark, Province of Ontario. Reports have come from German South East-Africa of the discovery of a dark mica, probably phlogopite, and that mica mines are in actual operation, but so far nothing is known of the extent of the deposits. Since the application of mica for electrical purposes the production of this mineral has attracted, on account of its abundant occurrence in Canada the attention of mining men and capitalists of the Dominion. Canada has long been known to be rich in economic mica deposits. More than 40 years ago Sir William Logan (Geol. of Canada 1863 pp. 494 and 795) referred to the Phlogopites of Grenville Que. and in North and South Burgess, Ont. in all of which says Sir William, the mica is obtained in large sheets, which, being transparent and free from flaws, are wrought and employed for the same purposes as the muscovite or potash varieties. "A crystal from Grenville was so large as to furnish sheets measuring twenty-four by fourteen inches." Good mica, we are told, was found on the 10th lot of the 5th range and on the 1st lot of the 10th range of Grenville, as well as further to the westward of this township. On the 17th lot of the Township of North Burgess large crystals of magnesian mica were found in abundance in a bed of pyroxenic rock. The mica was traced for about 300′ and considerable quantities were extracted. It appears, says Logan, that in this region and in Grenville, sufficient quantities of mica could be obtained for a larger demand. Another early producer of phlogopite was the Sydenham Mica Mining Co. in the Kingston district, while large quantities of mica were raised in connection with phosphate mining at the Blackburn mine at Perkins Mills, P. Q. from the year 1875 up. Practically speaking an impetus to mica mining was given by the extensive operations in the phosphate mines of Ottawa county. During these operations mica was more or less a dominant factor in the mineral raised, in some cases so much so that the quality of phosphate was seriously impaired. As mica was then unsaleable it was thrown into the dump as useless, and it was only in the year 1890 that the demand for this particular mineral commenced. Experience was gained as the mode of occurrence in connection with phosphate mining and this experience aided considerably, when operations for mica were seriously attempted. Many phosphate mines were worked both for mica and for phosphate, but the peculiar character of the mica deposits did not admit of mining profitably two minerals. Phosphate mines gradually turned into mica mines, the phosphate being only mined, when in immediate vicinity of the mica deposits. As to the geological occurrence of mica deposits, it must be stated that, as the latter appear to have the same relation to the pyroxene rock in which they occur, as the phosphate of lime or apatite, we must reasonably suppose that, many data, concerning the geological deposition of phosphate are good also for mica deposits, especially in their genetic relation to the containing formation. We find that the Laurentian formation in which the phosphate and mica deposits are so largely developed, consists

1. Of red, grey and white orthoclasegneiss in great variety, distinctly banded.
2. Black hornblende and mica gneiss, often garnetiferous and cut by veins of white and red oligoclase.
3. Pyroxenic gneiss, banded.
4. Large bands of crystalline limestone.

These rocks may be considered the typical rocks of the great Laurentian formation; they are distinctly stratified and dip generally at all angles from almost hoirzontal to vertical. In the country north of the Ottawa river and in the vicinity of the Lievre river all the members of the Laurentian are represented and are characterized by the intrusion of large pyroxenic dikes. The intrusive character of these dikes was clearly recognized by the many openings which have been made in the apatite and mica deposits of the Gatineau and Lievre districts. We find that generally the strike of the limestone is east of north 150°, the strike of pyroxene, quartz, feldspar and other dike like intrusions at right angles, but sometimes conforming with the bedding of stratified rocks.* The deposits of apatite and phlogopite mica are confined entirely to these pyroxene dikes, while it is erroneous to suppose that mica occurs also in limestone, as has been asserted by many practical miners. Near the contact with the grayish gneiss, an irregular development of calcite, generally of a reddish or pink color, occurs and while it is true that good crystals of mica, mostly of a perfect form, are found in this calcite, it must be borne in mind that the latter occurs only in small irregular pockety deposits in the intrusive pyroxene. The horizon of these apatite and mica deposits is confined to the upper portion of the Laurentian silicious rocks which underly the large bands of massive limestone so frequently met with in the Ottawa Valley. These gneisses are of grey or reddish grey appearance, contain reddish or hornblendic bands, generally with a large percentage of quartz. These beds occasionally penetrate calcareous layers into the massive crystalline limestone formation. In the Lievre and Templeton districts apatite and mica are rarely found in dikes cutting through the limestone strata, but in the Gatineau area

*Dr. Ells, Geol. Society of North America, 1893.

many large dikes of pyroxene cut the limestone and contain mica deposits of commercial value.

FIG. 10.—Mica vein, Wallingford Mine, Township of Templeton, P.Q.

Mica deposits occur in pockety masses, composed of mica crystals and micaceous matter either in pyroxene or on the contact between this rock and the adjacent gneiss. Where the mica occurs as a contact deposit, pocket of irregular bunches of calcite are associated with the pyroxene. Generally speaking the mica crystals found in calcite are of perfect crystallization and basal cleavage and yield a fine commercial product. Crystals of apatite are frequently met with in association with the mica and penetrate occasionally the latter. Inclusions of calcite are found very often between the laminae, destroying however the quality of the mica to a large extent.

(*To be continued.*)

Exhaust Steam Boiler Feed-Water Heaters; Hot Water Pumps and Pumping.

By W. D. L. HARDIE, C.E., M.E., Lethbridge, N.W.T.

(*Continued from May issue*)

DESCRIPTION.

Cast iron, copper and brass are used for all parts exposed to steam and water, because they do not quickly deteriorate from corrosion and acids. This will present itself in many accommodations but may be said to be absolutely necessary.

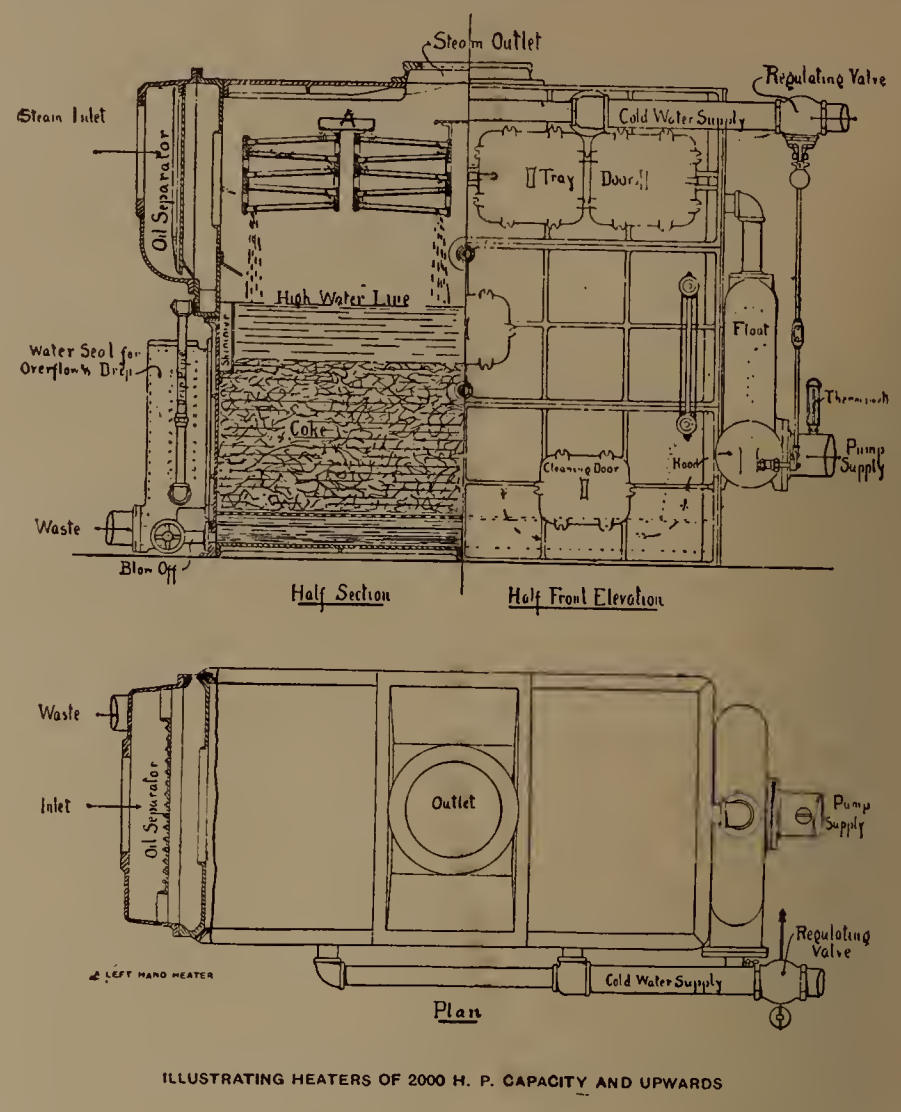
The form of this heater is shown by the illustrations. Each side is formed of one or more strongly ribbed parts bolted together at the flanges and made steam and water tight with rust joints calked from the inside. Suitable stay tubes and bolts are used in the large sizes, so that the shell being strong and rigid will not be affected by the pulsations of the exhaust steam.

The top and bottom plates are also of cast iron, the latter being either dished or set at a slight angle to permit of complete drainage through the blow-off pipe.

The oil separator through which the exhaust steam enters the heater is bolted on the outside of the shell and is shown sufficiently clear in the above cuts to require no further explanation.

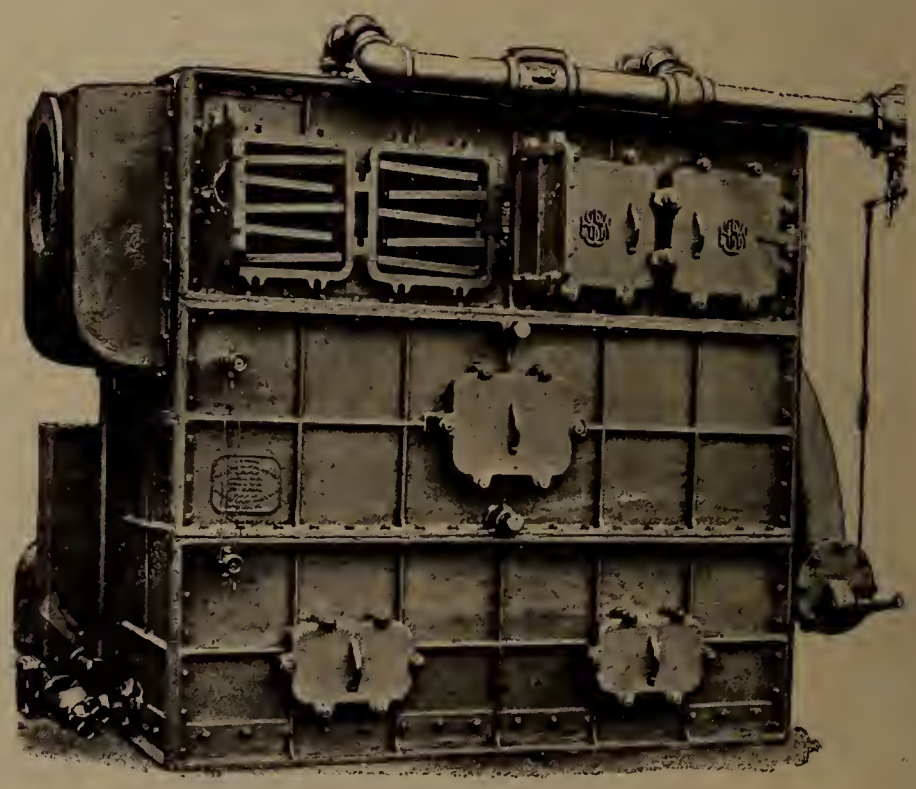
The upper portion of the heater contains the trays which are interchangeable and removable. Each is inclined, and the edge over which the water flows is serrated, or saw-toothed, for breaking up the water.

The trays are held in place by the cast iron guides, securely



bolted to the shell of the heater in such a manner that they can not be dislodged by the pulsations of the exhaust, though they can be readily removed through the clearing door openings.

Each set of trays is suspended in the steam space, with passages between the tray supports and the sides of the heater giving far greater area for the passage of any surplus exhaust steam through the heater than the area of the exhaust inlet open-



ELEVATION.

ing. This arrangement provides for delivering steam *by induction*, through the openings in the tray guides to the water, as it flows from tray to tray.

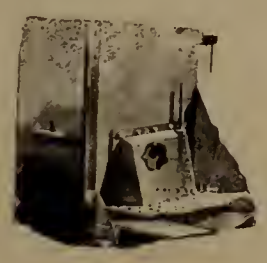
A brass pipe (with ell and nipple at end), from the opening on the heater through which the cold water enters, conducts the water to an open distributing box or trough extending across and above the trays. Slots are provided in the bottom of this box through which the water flows on to the upper tray.

Outside the heater on the inlet pipe, is placed a double disc or balanced valve for regulating the cold water supply, which valve is controlled by a ventilated copper float carried in the heater. Any change in the level of the water raises or lowers this float, opening or closing, by crank and lever connections, the regulating valve, thus keeping supplied the demands that are being made upon the heater for hot water and preventing any waste of water through the overflow.

The ventilation of the float is accomplished by using a hollow brass stem connected to a hollow axis, the end of which projects without the heater. Any water that may accumulate in the float from sweating through the copper or from breakage will be shown on the stem outside the heater.

Just above the working level of the water is placed the *skimmer*, extending the width of the heater which, in addition, furnishes the overflow opening. This trough is drained through an opening in the side of the heater into the water seal or trap, which seal, while of ample size, and perfectly open, carries a sufficient head of water to withstand a pressure of about one pound per square inch. This arrangement effectually seals the opening and prevents the entrance of air into the heater when *drawiug* the steam supply without using a check valve.

To provide for carrying additional depositing surface in the form of a filter bed, heaters should be furnished with perforated cast iron plates or shelving on which the material used is placed, thereby ensuring the passage of all the water through the filtering bed, and providing an easy course to the pump suction via the hood. These plates form a false bottom, being set about four inches above the bottom of the heater.



Showing vented hood protecting pump suction.

Covering the outlet to the pump and extending down to the coke shelving is a hood, open at its under edge for the passage of water and vented by a pipe at the top to prevent possible air logging and consequent interference with the flow to the pump. This pipe also prevents a syphoning of the water from the heater, thus maintaining the seal for keeping the floating impurities from the pump suction.

It will, perhaps, have been noticed that some attention has been paid in the construction of all the heaters described, excepting the one shown in Fig. 4, to the induction, or vacuum, principle. This principle we regard as one of the highest importance in exhaust steam heaters.

We think we have perhaps already devoted too much attention to the subject of the first part of the title of this paper—"Exhaust Steam Boiler Feed Water Heaters", and will now briefly take up the latter part—"Hot Water Pumps and Pumping"

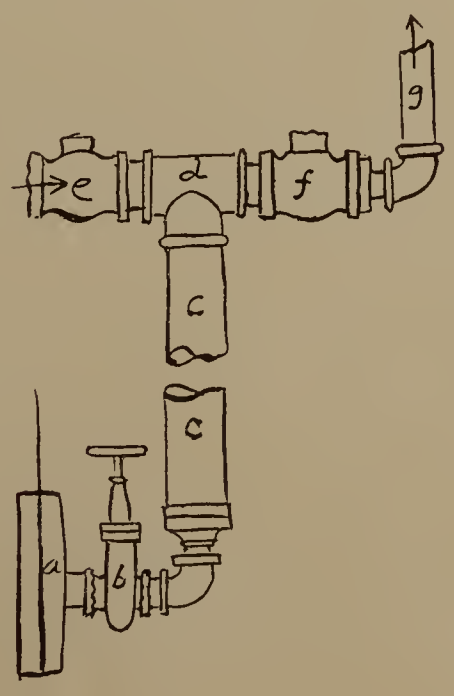
When water gets to 110°F it is not safe to depend on any of the injector or inspirator types of feeding pumps, and the water must be delivered into the boiler by a force pump of positive action.

Pumping hot water is a very difficult problem, and its limitations of lift and temperature are very positive. As a general proposition, it may be fairly said that, at sea level, a pump will not lift any water at 200°F. For boiler feed purposes, at sea level, the pump should be set at least 2 feet below the supply, and the greater the distance the pump is set below the supply the greater will be the satisfaction in the pump's operations.

In designing pumps it is customary to allow a flow of 200 ft. per minute in the suction pipe, 300 ft. per minute in the discharge pipe and a piston speed of 100 ft. per minute in water cylinder, making allowance in the cubic area of the cylinder for 25% of slip, but this rule when pumping hot water must be modified if good results are to be had. It is a safe rule to give the suction water a flow of 100 ft. per minute and reduce the piston speed to 35 ft. per minute. The writer has gone through a wide range of experience, and while he would not say that this rule should not be departed from, he does affirm that it is the only rule that will guarantee a steady supply of hot water to the boiler if the plant is large, and meet emergencies satisfactorily.

In connection with the suction there should be an open stand pipe, the open end being about 2 ft. above high water mark in the heater. This will allow some of the vapour to pass off in the passage from the heater to the pump, and also offers a ready cold water connection to the pump by enabling one to turn a stream of cold water from the tank into the stand pipe. The writer has also found it advisable to put a small pipe, say ½", in the suction close to the pump, which can be used to reduce the pressure of the vapour which sometimes is so great that the pump does not get a full supply of water into the cylinder and immediately begins to jump or hammer. A very little water through the ½" pipe corrects this without a perceptible reduction in the temperature of the feed water.

There is also the difficulty of furnishing sufficient air chamber area to prevent hammer in the delivery pipe which is very effectually overcome by the automatic air pump shown in cut below. This cut and description of its action is taken from "Pumping Machinery," by Wm. M. Barr.



A piece of 2½" wrought iron pipe (c) about 30" long is connected to the end of the pump cylinder (a) in a vertical position, by means of a gate valve (b) or cock. A 2½" tee (d) at the upper end of the pipe is connected at one end of the run with a 1¼" check valve (e) opening inwards, and at the other end with a ¾" check valve (f) that opens outwards. The valve (f) is connected with the air chamber through the pipe (g).

The air pump is operated as follows :—When the pump is working, open the valve (b) to fill the pipe (c) with water ; then partially close (b) until the check valves (e) and (f) begin to work. This is easily determined by the check of the check valves when seating.

Its working may be described thus :—When the valve (b) is opened, water fills the pipe (c) from the pump cylinder (a) during the discharge stroke of the pump. By partly closing (b) when (c) is full, the pump during the suction stroke will draw a part of the water from (c) and air will flow on through (e) to take its place. During the next discharge stroke of the pump, more water is forced into (c) driving the air out through (f) and (g) into the air chamber. If (b) is opened too wide all the water will be drawn out of (c) during the suction stroke and air will be drawn into the pump cylinder from (c) ; but by properly regulating the opening, a column of water is kept in (c) which acts as a piston that moves with the strokes of the pump and pumps air into air chamber.

Such an air pump will be sufficiently large to supply pumps with air that are delivering up to a million and a half gallons of water in 24 hours.

The water, by the use of this automatic air pump has got practically silent running in a pump that would have hammered itself and connections all loose in a short time without it.

On the discharge line there should be placed a relief valve so that when the water is shut off, or partly shut off, at the boilers, the pressure will open the relief valve, which has a connection into the open stand pipe on suction before referred to, and allow the water to flow back into the pump suction. If there is not a man in attendance upon machinery close by, the pump may advantageously be equipped with a speed governor.

Having settled all the foregoing points, it is now a matter of making a proper selection of pump and valves.

The writer, after 25 years intimate experience with high pressure pumping, has become very partial to double acting outside packed plunger pumps, with both suction and discharge valves put in the top of the pump, pot fashion, and held in position by glands. In such a pump individual valves can be examined without taking any other piece of the pump apart. The plungers being outside and outside packed, and the valves outside, there is never any cause for doubt as to what part of the water end is out of order when the pump will not do its duty. The writer uses the outside packed plunger pump to the exclusion of all others, but for low resistance in discharge line he uses the common style of plunger water end and valves ; but for high duty he always uses the pot shaped valve.

Such a pump is more costly when purchased, but is much cheaper in the end. There is a pump of this kind which has been under the writer's charge for nearly eight years and up to date it has only cost $50.00 for repairs, and has not failed for a single hour in all that time to meet every requirement. It pumps regularly against the head equal to 150 lbs. per square inch.

Such pumps may be either single or duplex. The duplex has the advantage of steadier flow, but the stroke of the one piston is dependent for its steam on the stroke of the other piston, and on this account presents some difficulties that may not balance the steadier flow.

Undeveloped Mineral Resources of Ontario.*

By WILLET G. MILLER, Provincial Geologist, Toronto, Ont.

Complaints, whether just or unjust it is not our province to determine, are often heard to the effect that our neighbors to the south have usually gotten the better of us in the various treaties and conventions which have been held between the two countries from 1776 onwards, but it is recognized by few that certain natural agencies, even before the time of Adam, were working in behalf of our neighbors, in an agricultural sense at least, and against us. A large part of the soil, which undoubtedly covered our new rocky areas at the end of the Mezozoic era, was transported to the southward, across what is now the international boundary, in the succeeding era by the ice sheet which completely covered the territory which we now call Ontario. What would have become, long ere this, prosperous homesteads and and rich agricultural communities, were forever rendered impossible by the movements southward of the great glaciers, whose effects, greater than those produced by the greatest of invading armies, are to last through all time. While the Canadian agriculturist may regret that many a fertile plain and valley in the Republic owes its prosperity to the stealing of our soil by the ice kings, his brother, the miner, rejoices that old mother nature in that far distant time was working for his benefit. By carrying away the soil she exposed the ore-bearing rocks to his view.

We hear a great deal of what heated waters and volcanic action have accomplished in the formation of ore deposits but no one has yet come forward to champion the glaciers, to whose action in many parts of the world the mineral industry is so much indebted. They seem to have concentrated the gold in the far famed Klondike; they have scoured many a mountain and plain exposing the treasures in the rocks beneath ; they have furnished us with many a lakelet and water fall, and have rendered picturesque many a region whose landscape would otherwise have remained monotonous and unattractive.

It is difficult to state definitely what part of the 220,000 square miles embraced in the territory of Ontario possesses a rocky surface and is not adapted to agriculture. It probably is about one half. Over this broken region there are what have been roughly classed as two great groups of rocks, the Laurentian and the Huronian. We have been educated in the belief that the Huronian is *par excellence* the mineral-bearing system of the two, and that the Laurentian, with the exception of the crystalline limestone and associated rocks of the Grenville series, was to be considered of little economic importance. Much of what we call the Laurentian system is composed of acid plutonic and metamorphic rocks, granites, syenites and gneisses. We have been told that these particularly, which occupy vast areas, were of very little importance, as the store houses of economic minerals. Prospecting and development work during late years have, however, disproved the old beliefs concerning this series. In fact I look forward to some most interesting mineral discoveries being made in these maligned rocks. Mica, which with the advancement in electricity is likely to become still more important, is found in what appear to be economic quantities in many coarse grained granite. Heretofore the mica mined in this Province has been practically all of the phlogopite variety, which is found associated with apatite, calcite and pyroxene. The greater part of the muscovite used on this continent has been imported from India. One of the chief electrical firms in the United States is now planning the development of muscovite deposits in Ontario to replace that from India now used by them. This promises to become an important industry as white mica is found in many

*Paper presented at the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

ocalities from the western boundary of Quebec to the eastern border of Manitoba. Micanite has brought about the use of smaller sheets of mica than could be used a few years ago and many of the muscovite deposits considered of no value at that time, now contain merchantable material. Then these Laurentian granites are known to be the store houses of many rare minerals, some of which have at present economic uses and others may be expected to have at no distant date. The only specimen of wolfram, the ore of the metal tungsten which is used in a steel alloy, ever found in this Province was attached to a boulder of the heretofore much despised Laurentian granite. Again the only deposit of Columbite, a mineral which has recently come into commerce, occurs in a coarse grained granite dike. Within the last few years an important corundum industry has sprung up in one of these formerly so called barren granite districts; the mineral has been found at numerous points in belts of these rocks which have a known length in the Province of about 100 miles. Other examples could be given to show that the larger, hitherto neglected, Laurentian granite areas are well worthy of the attention of the prospector. Enough has, however, been said to show that these rocky areas are not to be left unconsidered when estimating the value of our undeveloped mineral resources. They already furnish us with a greater variety of economic minerals than the Huronian and younger formations which in years gone by were the favorites of the prospectors. Our mineral-bearing areas are therefore much more extensive than they were formerly thought to be.

To worthily justify its title this paper should possess the size of a large volume. Our undeveloped mineral resources are extremely varied in character.

The writer showed in a paper published in Vol. V. of the Journal of this Institute* that Ontario produced as great a variety of minerals as probably any other area of the world of like extent. My object, however, is not to attempt a detailed description of these resources, even had time permitted, but to give a rough outline of the field that lies waiting for the mining man in this Province. In order to do this systematically, but briefly, I shall use a classification, which has long been adopted by the Geological Survey, and divides the useful minerals and rocks into several groups.

I.—Metals and Their Ores.

The ores of the following metals have been profitably mined in the Province, gold, silver, platinum, iron, nickel, copper, lead, zinc. A small amount of molyodenum ore has also been produced. Most of the other metals, both common and rare, which are used in the arts are found here. For example the richest ore of aluminum, corundum, is found, as already stated, over a large territory.
This substance, however, brings a higher price as an abrasive material than as an ore, and is consequently not used for the extraction of the metal. Titanium, which appears to be destined to play an important part in alloys, occurs in numerous, at present undeveloped, deposits. Tin has been found in small quantities in the vicinity of Sudbury and in Renfrew county. Mercury has been found at one locality, Silver Islet, in very small amounts. The metal tungsten, as already stated, has been found only in a boulder. Arsenic, the chief use of which is not in the metallic form, and other metals, which are employed in the arts in the form of oxides or other compounds, will be discussed under other headings.

Considering the extent of territory over which gold deposits occur in the Province, and the numerous areas in which prospectors have done more or less work on them, it must be admitted that we have large undeveloped resources in this metal. The present state of our gold mining industry is due chiefly to incompetant management, stock-jobbing and other speculative factors—the parasites which attack the industry in all countries while it is in a weak, undeveloped state. It is to be expected, however, that after the epidemic has spent its force, like those which at times attack our bodies, the industry will be in a sounder condition and will soon reach such a state of healthy development that parasites will be ineffectual to injure it. Our President has stated that the most promising gold prospect he axamined while in the service of the Geological Survey, in the Lake of the Woods area 21 years ago, has lain untouched ever since, being tied up through the belief of the owners that they could make a profit through some one else's expenditure. Mr. Carter shows in his paper that we have nothing to fear from the deep development of our gold mines.

Such factors give us confidence that the undeveloped state of our gold deposits in not due to the quality and amount of ore. We have, therefore, reason to place a value on our gold fields of the Hastings districts, Wahnapitae, Michipicoten, Thunder Bay and Rainy River, as promising to be important assets in the future. Then there are the placer deposits which stretch for many miles along the Vermillion river, and those of Sturgeon Lake which cover a large area. Under more favorable conditions some at least of these areas should be worked at a profit.

In the district surrounding the head of Lake Superior we have had one great silver mine, and a group of others which have produced a considerable amount of the metal. Five hundred miles to the east of this, across a region, much of which is difficult to access, and practically unexplored, very promising silver deposits have recently been discovered. It is not reasonable to conclude that the great intervening region, over a large part of which similar rocks occur, contains probably numerous undiscovered deposits.

The metal platinum, which is frequently associated with the noble metals gold and silver, in nature, is found in the Sudbury ores. Unfortunately the most promising deposit of this metal yet discovered has lain dormant since its discovery for 15 years or more, owing to differences among shareholders—a cause which is primarily responsible for the undeveloped state of other important ore bodies in this Province.

The areas occupied by rocks which give promise of containing workable iron deposits occupy a greater extent of territory than those in which there are fairly definite indications of any other metal. Neglecting for present consideration the older explored areas in south-western Ontario, the iron range formations which surround the Ontario side of Lake Superior and extend westward towards Manitoba, and eastward to the Quebec boundary have an aggregate length of several hundred miles. As many parts of these ranges possess characteristics similar to those in the Lake Superior regions of the United States it must be admitted that this Province in all likelihood possesses vast undeveloped iron resources. It is to be hoped that they will not be tied up like some other of our mineral deposits. In the northern and western parts of the Province there is only one iron mine which has been a producer of importance. This deposit owes its development largely to favorable situation. As facilities for transportation are supplied to more remote fields others will undoubtedly become producers.

Their magnetic properties distinguish iron, nickel and cobalt from all other elements. The iron-bearing formations of Ontario are not less in extent thon those of any other part of the earth of equal areas. The Province has only one competitor as a nickel producer, and her undeveloped resources in this metal appear to be unequalled. The deposits which have been developed form only a small percentage of those known to exist in the Sudbury area.

*Eastern Ontario: A region of varied Mining Industries Journal Can. Min. Inst.—Vol. V., P. 233.

Cobalt does not come into commerce as a metal but as an oxide. It is found in Ontario in deposits richer than are known to occur elsewhere. If the promise which the recently discovered deposits give is fulfilled no country will be able to compete with this Province in the production of cobalt. The market for the oxide of the metal is restricted, and our ores being so much richer than those found elsewhere should control the market.

Is there not something strange in the fact that this group of three metals—iron, nickel and cobalt—which possess properties different from all other elements should be found in unsurpassed quantities in this Province? Have magnetic influences had something to do with their concentration? Or is it owing to the fact that in our Province a large area of the oldest known rocks are exposed? Probably during the early period of the earth's history these magnetic metals occurred abundantly near the surface. More recent formations have been formed by the breaking down of these earlier formed rocks and the metals, especially nickel and cobalt, have been scattered. It may be said that our deposits of the three metals do not occur in our oldest rocks but in rocks which are of Animikie or later ages. The eruptives, whether massive or fragmental, which are associated with the deposits, were formed, in all probability from material which existed not far from the early surface and had not been worked over by agents of denudation.

Copper deposits are numerous in the territory bounded by the lower end of Lake Superior and the upper end of Lake Huron. Considerable development work has been done on these deposits during the last few years and it would appear that a fair percentage of them will become producers. During the last decade, or more, copper has been produced in association with the nickel ores of Sudbury. All these nickel deposits carry copper and Ontario will in the years to come be credited with a considerable amount of the metal from the nickel mines, now so much in demand for electrical and other uses. Another copper mine, that of Massey Station, has recently become a producer and the Province has, chiefly, to thank the tireless energy and skill of that veteran metallurgist of this Institute, Major Leckie, for this much to be desired consummation.

Outside of the district embraced in the southern portion of Algoma and western Nipissing the only copper property which has received serious attention is that which is now known as the Tip Top mine, west of Port Arthur. This mine has reached a stage of development which the owners consider warrants them in erecting a smelter.

The success already achieved in the copper industry, together with the knowledge that many deposits over a large territory, are as yet untested, should lead us to conclude that the Province has a good future ahead as a copper producer.

The metals lead and zinc are commonly found associated in nature. Most of the deposits of these metals throughout the world are in rocks younger than the Archean, and from what I have said concerning the magnetic metals it might be inferred that lead and zinc would not be found in the Province in large amounts. These metals show a tendency however to make their abode in limestones wherever they can find them. In our Grenville series crystalline representatives of these rocks are found, occupying large areas and the metals occur at numerous points. The character of the deposits of these metals is, however, characteristically difficult to determine, and they are often hidden, owing to the softness and easy weathering of the limestone. Hence there is reason to believe that many of these ore bodies are yet awaiting discovery. Zinc deposits have been worked in both the eastern and western parts of the Province. Work on Lake Superior deposits ceased a couple of years ago but a mine in Frontenac county has been producing ore in small quantities for two or three years, and can, apparently, continue as a producer for years to come. This latter mine illustrates what I have said about the difficulty often experienced in discovering deposits of the metal. It is situated in a cleared field in a part of the country which has been prospected for years without the deposit being located.. That metamorphic or Archean areas are not to be avoided by those in search of zinc is shown by the fact that the great deposits of New Jersey are in limestones similar in character to those of our Grenville series. And although the great Missouri zinc-bearing rocks are not of Aachean age still they are rather clearly connected with those rocks. In that State, isolated knobs, representing peaks of mountains which rose from the Archean surface, project through the later sedimentary formations.

The lead deposits of Ontario are similar to those of zinc, and what has just been said will apply to them. We have, in Hastings county, one working lead mine, with a small smelter, and it is not unreasonable to suppose that other deposits, both known and unknown, will be worked in the future.

Having made this rapid survey of our metallic resources I shall now rapidly review the other groups of economic minerals found in the Province.

II.—Minerals used for Grinding and Polishing.

I have shown that Ontario has unsurpassed resources in iron and nickel, which form an alloy which is to be the metal of the 20th century. In the manufacture of machinery, utensils, and other articles composed of metal, a substance is needed to smooth down the rough castings and forgings. Mother Nature in furnishing us with these great metal deposits did not forget to supply us with the mineral needed to polish the metal and put it into marketable form. Hence, she gave us the great belt of corundum-bearing rock that is found in south-eastern Ontario. Already two plants have been erected to extract corundum from these rocks and there is room for others. One of these plants, which is just completed, is surpassed in size in comparatively few districts in which concentration is being carried on.

Formerly it was the custom to use the lathe almost exclusively in shaping up and reducing the parts of machinery and other metallic articles. The lathe is now being replaced by wheels of abrasive material, which do the work more cheaply and accurately. In working the harder metals and alloys corundum has been proved to have no equal, either among minerals or artificial abrasive materials. Hence it is natural to conclude, when we consider the development already done and the numerous deposits still lying dormant, that Ontario has very valuable assets in this abrasive substance.

III—Refractory Materials.

Possessing the wealth in water powers that we do it is fortunate that there are found in the Province large deposits of graphite or plumbago, a mineral which is of great importance as a furnace lining. Deposits of this substance are known to occur in several localities. Two are being worked and others have had preliminary tests made on them recently. Soapstone and other substances said to withstand the heat are also to be found. Ontario's graphite exhibit was one of the striking features in the mines building at the Buffalo Exposition.

IV.—Minerals used as pigments.

Pigments or paint materials are produced from a number of minerals, some of which, lead and zinc, have already been mentioned. Our cobalt deposits, however, promise to give us the highest standing as producers of metallic, material, used for coloring purposes. The ore bodies recently found in the vicinity of Haileybury contain ore running 16 per cent in cobalt. The present supply of the metal comes chiefly from New Caledonia, and the ore as mined there does not run a quarter of this per-centage. Other mineral pigments occur in the Province but do not need special mention.

V.—Gem stones.

Stones of this class have not been found in the Province, although the opaque variety of the ruby and sapphire (corundum) as already shown, is abundant. Common beryls are also found, but, as yet, not the gem varieties, emerald and aqua marine. Several minerals which when cut and polished have a handsome appearance have been used to some extent. Several writers have drawn attention to the fact that diamonds likely occur in our northern districts. Judging from the facts that these stones are found in drift deposits to the south of the international boundary, and that carbon, e.g., the Sudbury coal, and graphite elsewhere, are found in close association with basic eruptives, there seems to be good reason to believe that diamonds may yet be discovered in northern Ontario.

VI.—Minerals used in certain Chemical Manufactures.

Probably no chemical manufacture is more important than that of sulphuric acid. There are two working iron pyrites mines in Hastings county. These mines are on deposits which have been known for years, but lay dormant till recently. The mineral is found in promising amounts in many other localities. The great length of the iron-bearing range has been mentioned. Belts of rock carrying iron pyrites run parallel to these and appear to carry pyrites in important amounts. Near the Helen mine a large deposit of pyrites has been tested by the diamond drill. Some hundreds of miles to the north-westward a pyrite deposit, situated near the iron claim on the Steep Rock Lake has also been drilled into. Pyrites is found in considerable abundance near Lake Temagami. Mr. Sjostedt in a paper read at this meeting describes a method of manufacturing sulphuric acid from pyrrhotite, our deposits of which are of large size and numerous.

Molybdenum and other minerals which have been mentioned come under this heading to some extent, as they are used in chemicals.

VII—Minerals used in Agriculture.

Our phosphate deposits which are found over a large area in south-eastern Ontario have lain idle since the discovery of the lower grade but more cheaply worked deposits of the southern States. A large supply of gypsum, another mineral of value to the agriculturalist, is found in abundance along the Grand river in older Ontario, and on the banks of the Moose in the north the substance appears to occur in considerable quantities.

VIII.—Fuels and Illuminating materials.

For years past the south-western peninsula of Ontario has been an important producer of petroleum. During the last two or three years the supply has declined. That this part of the Province still has important deposits of oil admits of little doubt. Heretofore this substance has been looked for practically only in the Corniferous formation, in which the first wells drilled happened to occur. Within two or three months oil has been struck in promising quantities in two other formations, which up to the present have received little attention from those interested in the industry. One of these formations lies 700 or 800 feet below the horizon from which oil is obtained, and the other is still older.

In that great, practically unexplored, region of the Province which occupies the James Bay slope, the Corniferous rocks are said by Dr. Robert Bell to occupy a greater extent of territory than is embraced in the whole of the south-western peninsula of Ontario. Is it not more than likely that both oil and gas will be found in the northern region when it is rendered accessible by the building of railways? Niagara and other formations also occur there. In fact it presents practically the same geological conditions, but on a larger scale, as the older part of the Province which has already proved to be productive.

New gas pools have been exploited recently and what has been said concerning oil applies to this very useful substance.

After years of experimenting the problem of briquetting peat in a form suitable for our market seems to have been solved. If this is the case the numerous large deposits of this fuel in older Ontario will add very materially to our annual income. When the more northern territory is opened up deposits enormous in extent will be rendered available.

It will be admitted, I think, from what I have said that the Province has very large undeveloped resources in these three important substances.

IX—Materials for Brick, Pottery and Glass.

Materials suitable for brick making are found in abundance in older Ontario, and beyond the height of land, in the great clay belt of 16,000,000 acres, bricks should be a very popular material in the settlements that are to come.

The pottery industry is only in its infancy in Canada, and there is likelihood of great development. Feldspar is a mineral which is in great demand for use in the manufacture of pottery. During the last three or four years one of the largest known deposits of feldspar has been opened up in Frontenac county. The quality is such that it is in much demand in the United States. It may be added that feldspar, of which there are many promising undeveloped deposits in the Province, is one of those minerals which are found in the formerly much despised Laurentian.

Our glass industry is in much the same position as that of pottery. Even the common raw materials. such as lime and quartz sand, have always been imported for use in our only two working factories, although raw materials of the right quality are to be found here.

X.—Cement.

The Portland or artificial cement industry has made rapid strides in this Province within the last decade, and there now seems to be little need of drawing on foreign supplies of this material. All of our working cement factories use marl as the raw material for the lime in their mixtures although a high percentage of the factories in New York state and elsewhere employ solid limestone, which, it is said, makes a saving in the cost of manufacture. It apparently was not known that Ontario had limestone in abundance pure enough for use in cement. One of the factories now being erected is to use limestone. The northern unsettled agricultural region tributary to James Bay is well supplied with this raw material required in the cement industry.

Cement is affecting some of the older industries and trade in some materials is now in a transition state. Cut stone for use in canal work and other structures is being largely replaced by concrete. Lime for use as a mortar is of less importance than formerly, Portland cement taking its place, especially in buildings which are erected in frosty weather. It is said that in Germany Portland cement has entirely replaced natural rock cement and it is probable that the same thing will occur here. Cement blocks, when further improved, will also affect the brick industry.

XI.—Stone.

The stone industry of the Province is in what may be called a pioneer state. We import all our granite for monumental and other purposes, although there is probably no country which possesses a greater variety of granite, either as to size of grain, color or other qualities, than Ontario. Trade prejudices are to some extent responsible for this. Scotland has for years been an important producer of granite for monumental purposes, and it has been the ambition of most Scotchmen to be buried under an Aberdeen stone. Of late years the Scotch granite has met competition in New Brunswick and elsewhere,

but the stone is probably passed off as the Aberdeen, and many a son of old Scotia sleeps his long sleep as peacefully under one of these as if it were the genuine.

Marble stands in about the same category as granite. Trade prejudices and the competition of large foreign quarries have prevented the development of the numerous and varied resources in this material which are to be found in Eastern Ontario. Attempts have been made to work marble at a number of points in the Province but the works have never got down to depths sufficient to be below the influence of surface agencies, and the quarries have been given up practically untested. Renfrew is the only locality which produces marble at the present time. Some wealthy and patriotic citizen of Toronto or some other of our cities would be doing a good service to the country if he would erect a residence of marble and thus show that we have material as good as is to be found elsewhere. There is a marble residence in Brockville but the material was brought from New York State. Marble should also be used in some of our public buildings. What an advertisement it would be if considerable marble had been used in the Science building now being erected in this city! How long, having the resources we do, shall we continue to import our marble from Maine, Georgia and other States?

Jasper, Agates, Porphyries and other rocks and minerals used for decorative purposes are found in considerable variety here but little use is made of them. The tourist on Lake Superior who buys a polished agate, for the reason that it is said to be found on the shores of that inland sea, and he desires it as a memento of his trip, often "gets taken in." Most of these agates originate in South America. They are taken to Germany where they are polished and stained, and shipped abroad to be sold to gullible tourists. These agates are about on a par with specimens that formerly were sold to tourists at Niagara Falls. The hawkers used to solemnly affirm that the rocks represented the solidified foam which gathers at the base of the Falls.

Limestones enters into probably more industries than does any other rock or mineral. The uses to which they, or their constituents, are put are almost innumerable, and the varities of these rocks which are required by one industry or another are numerous. The older part of Ontario contains limestones adapted to use in any industry. We have those which are practically pure calcium carbonate. These are found among the rocks of the Laurentian series, the Grenville, and in the Cambro Silurian; the Chazy, Bird's Eye, and Black River, and Trenton, being normally of this character as are those of the Devonian, the Corniferous and Hamilton and recent marls. While others of the Grenville series and of the Upper Silurian system—the Clinton, Niagara, Guelph and Onondago—contain magnesia in varying percentages up to those which carry the highest amount of magnesia possible for a limestone, as distinguished from magnetite.

Limestones carrying a high percentage of calcium carbonate are a necessity in an important group of industries which have already been started in the Province and are sure to reach large dimensions in the future. Having no domestic coal some of our metallurgical industries, especially in the north, will be dependent to a considerable extent on charcoal, in the manufacture of an important by-product of which a pure limestone is a necessity. In beet sugar manufacture pure lime is also an essential; Portland cement manufacture requires limestone free from magnesia and certain impurities. In the manufacture of calcium carbide, an industry which is peculiarly adapted to this country, and as a flux for furnaces a pure limestone is also desirable. In the manufacture of sulphite pulp, on the other hand, a rock as high in magnesia as it is possible to obtain it is the most suitable. The fact that such rock is to be found here is important when we consider the field there is for the manufacture of pulp in the Province.

In many other industries lime or limestone is essential, and our supplies of this rock, of all kinds, is of greater economic importance than most people probably realize.

Conclusion.

That we should be optimistic of the future is shown by what has been accomplished in the mineral industry during the last decade. I shall conclude this paper by giving a comparative table, which speaks for itself, of our mineral productions ten years ago, and at the present time.

ONTARIO'S MINERAL PRODUCTION.

A RECORD OF TEN YEARS.

	1893	1903
Iron Ore	$ 0	$ 450,099
Pig Iron	0	1,491,696
Steel	0	304 580
Corundum	0	87,600
Arsenic	0	15,420
Feldspar	0	20,046
Iron Pyrites	0	21,695
Graphite	0	20,636
Zinc Ore	0	17,000
Pig Lead	0	1,500
Talc	0	2,625
Molybdenite	0	1,375
Calcium Carbide	0	144,000
Nickel	454,702	2,499,068
Copper	115,200	716,726
Gold	32,960	188,036
Silver	2,500	8,949
Bricks, etc	1,684,873	———
Stones, etc	721,000	———
Rock Cement	63,567	69.319
Portland Cement	63,848	1,182,799
Gypsum	7,363	7,910
Lime	364,000	520,000
Mica	8,600	102,205
Natural Gas	238,200	196,535
Petroleum, etc	2,188,690	1,586,674
Salt	149,850	388,097
Unclassified, etc	9,600	———
Total	$6,105,953	$12,870,593

On a Mineral Containing Radium in the Province of Quebec.*

By J. Obalski, M.E., Inspector of Mines, Quebec.

Since the new element "Radium" has been discovered, much attention has been called to the minerals containing it; so far, it appears that the Uranium ores are the only ones in which it has been found.

In our Laurentian formation Uraninité, composed of oxide of Uranium and other rare metals, has been met with in the pegmatite dikes which have been operated as producers of white mica (muscovite), and we have the records of the Villeneuve Mine, in Ottawa County, as to Monazite and Uraninite, and of the Maisonneuve Mine, in the County of Berthier, with Samarskite; we have also several other white mica mines and prospects in the Saguenay district, but so far Uranium ores from these have not been noted.

About ten years ago, I found in a white mica mine of the Saguenay district, then operated by the Canadian Mica Co., a remarkable specimen which I identified as "Cleveite," and which is shown in the accompanying photograph.

*Paper presented at the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

No. 1.

This specimen has a specific gravity of 8.43 and weighs 375 grams, or about 12 ounces, it is well crystallized in dodecahedron form, deriving this from the isometric system. A complete analysis has not yet been made, but the specimen contains 70.71% of Uranium oxide.

No. 2.

Radium having been discovered and found to exist mostly in connection with Uranium ore, I experimented with the above mentioned crystal, and found it affected photographic plates strongly, as shown by the accompanying radiographs (figures 2 to 8), which were taken exclusively by the radio active rays without the assistance of

No. 3.

No. 4.

light. Nos. 2, 3 and 4 were taken through wood, with a nine hour exposure, and No. 4 is a radiograph of silver coins; No. 5 is also a radiograph of silver coins but through galvanized iron and after a 26 hours exposure; No 6 is an impression of the crystal of Cleveite itself after a nine hours exposure, and Nos. 7 and 8 are impressions of other specimens of the same material after exposures of nine hours.

No. 5.

The specimen has also a well marked action on the electroscope. I, therefore, came to the conclusion that it contained Radium, and to have my opinion confirmed, I showed the specimen to Professor Rutherford of McGill University, who, after testing it, stated that its radio-activity was equal to four or five times the activity the crystal would have if it was entirely composed of Uranium, and that it con-

No. 6.

tained one-tenth of a milligram of Radium, making it comparable with the best pitchblende so far operated for the production of Radium.

This crystal may be an accidental one, although I have found other small pieces of the same mineral in this vein.

I have also found in this vein a carbonaceous material burning quite easily, and leaving a large proportion of ashes, containing oxide

No. 7.

of Uranium. Specimens of the above mentioned coal have been tested by Mr. Milton L. Hersey of Montreal, with the following results:

This "coal" has a fibrous, irregular structure and contains a small amount of mica; it proves to be of a similar nature to a non-coking bituminous coal, yielding considerable gas which burns with a bright, yellow flame.

Volatile matter (including volatile combustible matter and a small quantity of moisture)	40.185%
Fixed Carbon	52.59 %
Ash	7.225%
Total	100.00%

The ash itself was analysed and found to contain 2.56% of Uranium, based on the coal, which is equal to 35.43% of Uranium in the ash itself.

It is important to note that the color of the ash was olive green, due to the presence of oxide of Uranium.

In another test the coal was not burned but was merely finely pulverized and the powdered coal treated with boiling nitric acid to dissolve the Uranium compounds. It is interesting to note that the Uranium may be extracted by the direct treatment of the coal with nitric acid.

No. 8.

A specimen of this "coal" from the same place, tested in Montreal, was found to be radio-active, as well as the ash it gave, this radio-activity being due to Radium.

I am not able to state what the relation is between the two specimens of "Cleveite" and "coal," but I think this fact important, and I propose to make a further investigation next summer.

The white mica vein where these specimens came from is situated near the lake "Pieds des Monts," about 18 miles back of Murray Bay, in the county of Charlevoix, on the north shore of the St. Lawrence.

NOTE—Since the above was read at the Meeting, I have had a letter from Mr. P. Curie, of Paris, in which he says that the small piece of "Cleveite" from Murray Bay, which I sent him, shows a radio-activity equal to six times that of the Uranium.

The Percussive Theory.

Information is wanted about the Percussive Theory as applied to Colliery Explosions. During the progress of the damage suits against the Crow's Nest Pass Coal Company for compensation in respect of the Fernie disaster Mr. E. J. Beard, Principal of the Scranton School of Mines, boldly adopted this as the solution of the problem affecting the instantaneous death of men in distant parts of the mine. He held that, long before the blast or concussive force of the explosion could reach these men, percussive waves passing (like waves of ether in air) through the strata caused paralysis of the heart by shock and instant death. After this the blast might come along and produce mutilation and other evidences of force but they were not the cause of death—the swifter messenger had already done its work. He quoted Chatellier and Dixon in support of these views. The subject is, to say the least, profoundly interesting both from a scientific and practical standpoint, and, if it should be demonstrated that another and hitherto unrecognized force has been effecting the dire results attributed to explosive blasts and poisonous gases, the whole rationale of explosions will have to be revised and practical preventives adjusted to the requirements. Clearly the first result would be the total abolition of blasting in gaseous or dusty mines since detonation of any kind is intimately allied with the propagation of percussion. At present the matter rests on a purely theoretical basis and is the result of an inductive theory of reasoning to account for some physiological conditions not sufficiently explained by any known hypothesis. The question is whether it has a scientific basis and can be demonstrated.

Some Recent Improvements in Gold Dredges.

Among the recent improvements which have been made in the appliances used on dredges employed in working gold gravels is the substitution of a polygonal revolving screen in the place of the usual circular screen. In the ordinary circular screen the gravel and associated small stones have a tendency to lie in the lowest part of the screen, in a line parallel to the axis, and as the screen revolves this mass of material rises with the motion of the screen for a foot, or perhaps 18 inches, and then slides back to the lowest element; it does not turn over and over so as to afford rapid and continual sizing. To remedy this defect and to assist in turning over the material, bars of angle iron or similar shapes have been rivetted upon the frame work of the screen so as to carry up portions of the gravels and dump them again from a position varying from 90 to 180° of the turn. The introduction of these longitudinal bars has been accompanied with doubtful results: if these bars are too high up from the screen, stones and small pebbles get jammed between the screen and the bar, and frequently make one or more complete circuits, or, a large stone may be carried up to a

certain height and then fall, bruising, bending or damaging the sparge pipe The improved screen proposed is hexagonal, octagonal, or better yet, decagonal in section, which affords two or three distinct advantages. In the first place the polygonal section permits the screen plates used to be flat and to be put on in sections, thus making renewals easy and permitting the plates to be of any thickness: secondly, each flat plate, forming a side of the polygonal figure, carries up the gravel a greater distance than any circular shape would permit, and, when the material leaves that plate it falls or is dumped upon the plates below giving an impact to the wet gravel which breaks it up and is the equivalent of the jerking motion customary with a reciprocating screen: thirdly, there is much less tendency for the holes, or meshes, of the screen to become clogged as is frequently the case with circular screens. Another great advantage of the polygonal shape is that the plates can be thickened in the centre where the chief wear takes place, or, if perforated plates are used, they could be made of manganese steel (which is too hard to tool) and which would have the holes cast in it, and which, as experience has shown, is much less susceptible to attritional wear than any other metal known.

Another improvement noted is called the "Davis Patent Grapnel" which is intended to supersede the ordinary grab-hook used on the bucket chain. The construction of these grapnels is such that on reaching the polygonal bottom tumbler of the bucket chain they are made to project past and beyond the line of the bucket lips and tear into the gravels ahead, raking and working them up for the buckets which follow; as soon as these grapnels pass beyond the bottom tumbler they recede within the line of the bucket lips and remain there until their next passage round the bottom tumbler. The ordinary grab-hook used on the bucket chain does not project much, if any, beyond four inches beyond the line of the bucket lip, but it is the first thing to catch the drop shute when lowering the ladder; the grapnel hooks are stated to keep within the line of the lips when passing the drop-shute and in consequence the ladder may be lowered further with the grapnel than when equipped with the grab-hook.

The Matane (Que.) Copper Deposits.

In the annual report of the Quebec Department of Mines for the year 1902, Mr. J. Obalski, M.E., Inspector of Mines for the Province, made mention of an interesting occurrence of copper ore on the Gaspé peninsula. The comment made by Mr. Obalski, upon this occurrence is most interesting, and the subsequent exploitation which has been made by a corporation known as "The Matane Mining and Smelting Co." is again proof of the possibility of Quebec's possessing mineral resources which are at present little known and less appreciated by the inhabitants of that province.

The REVIEW has recently had an interesting interview with the engineer who has been in charge of the work which has been done on this deposit. It lies in the townships of both Tessier and St. Denis, in the county of Matane, and is found over a total area of about 1,000 acres, of which approximately one half lies in the 5th range of St. Denis, and the other half on the northern end of the 5th and 6th ranges of Tessier township. The cupriferous territory lies on foothills which extend along the northwestern slope of the Shickshock Mountains, and which have an average elevation of about 500 ft. above the St. Lawrence River.

The presence of grains of native copper in the boulders found along these foothills was noted some ten years ago in the reports of the Mines office, but no exploratory work was done until the summer of 1902. The Matane Mining and Smelting Co. (which has absorbed and united the previous local companies operating there) is prosecuting work with a force of about 15 men, and has a small plant of an hoisting engine, pump and steam drills in operation. Two shafts have been sunk upon a belt of limestone, which, for the greater part, is of a whitish color, but in places is colored black or dark gray in consequence of the admixture of a considerable amount of carbonaceous material, which strongly resembles the materal *anthraxolite*; these blackish portions of the limestone are notable as containing disseminated particles of metallic copper, and also as containing segregations of a secondary copper mineral, bornite.

The fundamental rocks of the Gaspé peninsula (according to the Canadian Geological Survey) are the schists of the Cambrian formation which are known as the Sillery and Levis groups. These schists are penetrated by dikes and intrusions of eruptive rocks of which diorite and diabase are the commoner forms. Lying along one of these bands or belts of diorite which forms, as it were, a wall for the belt of crystalline limestone just mentioned, occurs a wide stratum or belt of this limestone, with schist forming the other wall. The minerals which have been observed by the workers have been metallic copper in grains, green and blue carbonates of copper (malachite and azurite), cuprite, bornite and chalcopyrite, the latter of course being the prevailing copper mineral, but in many places the admixture of bornite with chalcopyrite is so plentiful as to substantially increase the percentage of copper obtained from the clean material. Metallic copper particles of considerable size have been found in boulders both of diorite and of limestone; on the surface of the land the largest piece of native copper known to have been found weighed between four and five pounds.

Assays show that the minerals of copper contain high values in gold and silver; a list of assays made by Mr. Armand Muscovici, the engineer in charge, show values ranging from $5.00 to $1260 to the ton. These assays, however, were made from portions of a deep diamond drill hole which was put down on the southeast side of the shaft to a depth of about 640 ft. The log of this hole shows the strata to have been quartzite, quartz porphyry and diorite in descending order; on the north side the sequence was schist, diorite and quartz porphyry.

Reference is made to this matter chiefly for the purpose of showing the possibilities of this portion of Quebec province. The Gaspé peninsula both on the St. Lawrence side and on the Baie de Chaleur side has given considerable evidence of the possibility of this peninsula becoming a considerable producer of mineral at no remote period, specimens of both lead and copper ores having been found along the foothills of the Notre Dame Mountains. Dwellers in the province of Quebec know very little of the resources of their own province and the REVIEW may, perhaps, be permitted to say to the Provincial Department of Mines that, there is yet a very large field in which that Department can exercise its best efforts in order to make the provincial resources better known to the public.

Pig Iron Statistics.

The quantity of pig iron made in Canada in 1903, was 321,190 tons.

The bounty paid on pig iron made from Canadian ores (46,450 tons) in 1903, was $125,415.00.

The bounty paid on pig iron made from foreign ores (274,740 tons) in 1903, was $494,533.00.

The production of steel ingots and castings made in Canada in 1903, was 235,122 long tons.

The bounty paid on steel ingots in 1903 (232,640 tons) was $628,131.00.

The bounty paid on puddled bars in 1903 (2,482 tons) was $6,702.00.

The production of nickel in Ontario for the year 1903 amounted to 6,998 tons valued at $2,499,068, this is the largest quantity yet produced by this Province.

BOOK NOTICES.

From the King's Printer comes a Government publication entitled—"Altitudes in Canada" accompanied with a relief map of North America, and four profile sheets extending from the St. Lawrence River to Vancouver. The work is of value as a reference book, and as such should have a place on the shelves of every engineer practicing in Canada.

The University Press, Knoxville, Tenn. has just issued the 4th edition of a vest-pocket book of engineering and other data, which not only is very neatly gotten up but is an unique method of advertising to the South the value of the technical training given to its students.

The success of the book is shown by the fact that the demand has already absorbed over 15,000 copies, and a fourth edition of 5000 has just been issued. In addition to the ordinary mathematical tables we note the introduction of several tables relating to electrical work, such as losses in wiring with voltages ranging from 200 to 2000, cost of arc lighting, &c. &c. The issue is a credit to Prof. Chas. E. Ferris, who has edited it.

Vol. X of "The Proceedings and Transactions of the Nova Scotia Institute of Science," has been received and is fully up to the standard of the previous volumes of this Institute. Among the papers which are of especial interest is one on "The Progress of Geological Investigation in Nova Scotia" in which Dr. R. W. Ells of the Canadian Geological Survey gives a clear and succinct account of the workers in that Province, and of the work they have done. Another interesting paper is a sketch of Mr. Andrew Downs by Mr. H. Piers. Mr. Downs was a native of New Jersey who came to Halifax in 1825, and founded the first Zoological Gardens in America in the City of Halifax in 1847, thus antedating the Central Park collection by 16 years.

The fourth annual "Copper Handbook" of Mr. Horace J. Stevens which has reached our table is the largest and most complete of the volumes yet issued. Chapter XV, containing detailed descriptions of the copper mines of the world. has been entirely rewritten and revised. The number of mines noticed has been increased by 50%, and the descriptive matter of the producing mines has been greatly enlarged. The growth of *The Copper Handbook* has been marvellous; Mr. Stevens started in 1901 with a list of less than 300 Lake Superior properties *only*, the number of pages in the first volume being 328; each year has seen an increase in the number of properties described and a widening of the field noticed until the present fourth edition covers the production of the whole world and lists 3311 different properties.

Not less marvellous is the thoroughness with which the information has been edited. It is impossible to avoid all errors, and the REVIEW has observed a few minor ones—for instance, the plant which the Rossland Power Company has erected to treat the low grade ores of the Centre Star and War Eagle mines does *not* use the "Elmore process" nor any *oil* process, but a method of progressive water concentration: neither did the Montreal & Boston Copper Co. ever smelt for "about $1.40 per ton."

The Copper Handbook is published by Mr. Stevens at Houghton, Michigan, and sold at the low price of $5.00 per copy, it is well bound in green linen. One of Mr. Stevens original ideas is the sending of the book, on request, to any part of the world, without any advance payment. The circulation of this work, while not large, is yet very thorough, reaching almost every country in the Universal Postal Union; everyone interested in the copper industry, in any of its phases, will find this handbook indispensable to him.

MINING NOTES.

NOVA SCOTIA.

The output from the Dominion Coal Company's collieries for May 1904 was 301.240 tons.

The Cumberland Railway & Coal Company's output from January to May 1904 was 165,718 tons.

Extensive improvements have been made in the Newcastle Collieries Co's. mine at Port Morien with the object of increasing the output of coal. Among other improvements are a Rand air compressor and two 500 h. p. Babcock & Wilcox boilers.

Rumor has it that Mr. H. M. Whitney, of Boston, and B. F. Pearson, of Halifax, who were the promoters of the Dominion Coal and Dominion Iron & Steel Companies, have formed a company and secured control of coal lands at Inverness Mines, Port Hood and Chimney Corner, together with the railroads now being operated there in connection with these mines.

Hereafter the several collieries of the Dom. Coal Co will be known by their respective numbers viz:—Dom. No. 1, Dom. No. 2, Dom No. 3, Dom. No. 4, (Caledonia), Dom. No. 5. (Reserve), Dom. No. 6, (New colliery, Big Glace Bay), Dom. No. 7, (Hub), Dom. No. 8, (International), Dom. No. 9, (Dom. No. 2 Harbor seam.) The No. 1 pier shall be known as Dom. 13 and the No 2 as Dom. 14.

The Mic-Mac Gold Mining Co. at Millipsigate, N. S., has put in a new air compressor and has also purchased a water power at Port Medway River. Electricity will be used to run the plant and light the mine. A ten stamp mill is now in operation and five more stamps will shortly be added. The shaft is now down 400 ft.

The Morgan Construction Co. which built the rod mill of the Dominion Iron & Steel Co., at Sydney, Cape Breton, now just about completed, will erect similar works in several places in Germany and France.

The manufacture of the material furnished by the Dominion Iron & Steel Co., is being undertaken in small part by local concerns. The Cape Breton Iron & Steel Co., one such concern, is to erect buildings to be used for a foundry and for a machine shop and forge shop, at Sydney, Cape Breton.

ONTARIO.

A small stamp mill is to be erected on the Steele property in Sturgeon Lake District.

The International Asbestos Co. has sold its property at Actinolite, Ont., to the American Cement Co., who intend to push the manufacture of the product.

The National Gold Mining Co. are said to be carrying on successful operations in the Manitou district. Work is progressing on the 100 ft. level and it is reported that a rich vein which crosses the shaft diagonally at 50 ft. depth has been cut on this level.

A despatch from Rat Portage advises that the Dominion Reduction Works at Rat Portage will have its mill kept busy this summer in consequence of a contract made with the Gold Reef Mining Co. to mill the large dump of ore which the Gold Reef Co. now have ready.

A company is attempting the concentration of merchantable iron ore from the iron ore sands found along the north shore of Lake Superior. The plant is to be located near Nipigon, and magnetic separators are to be used.

Location A. L. 282, Atikokan district, is again attracting attention owing to the placing of a small stamp mill on the property. A shaft has been put down to a depth of 280 feet, and several levels driven off. The vein is reported as averaging 3 feet in width and $7.00 in value.

Rumor has it in Rat Portage that Buffalo people have bought the old Champion mine and that work will begin at once. The Champion has a shaft some 200 ft. deep and several hundred feet of levels but no mill. The new owners are beginning cautiously as they propose a 5 stamp mill as a starter.

Mr. T. W. Gibson of the Bureau of Mines has sent an exploring party into the region north and west of Abitibi Lake. The party which will investigate the mineral and agricultural possibilities of the region, consists of Mr. J. G. McMillan, M. A. (in charge) with Mr. A. Henderson as agricultural expert. The region thus to be explored lies on the line of the projected Grand Trunk Pacific Railway.

It is stated that great activity is going on in the Manitou District. The Laurentian Mining Company's property at Gold Rock, is reported to be producing ore of extraordinary richness. Arrangements have been made for the completion of camps, installation of machinery and the erection of a 20 stamp mill, which indicates that the camp will be an exceptionally busy one this summer.

Mr. Robert H. Flaherty who has been prospecting the ranges of Ontario for iron ores for several years on behalf of certain iron corporations in the United States, announces that he is uncovering a big deposit of Bessemer hematite within one mile of the C.P.R. main line. Mr. Flaherty is reported to say that the deposit is of better quality than any he had seen with the possible exception of some portions of the Atikokan range.

The Honorable Commissioner of Crown Lands and the Director of the Bureau of Mines gave audience recently to Messrs H. Appleton and P. Primeau on an application for a provincial bounty on copper. The argument shown declared that the gentlemen named were interested in copper properties lying in the Township of Salter, that they could not dispose of their product without exporting the ore at very heavy charges for transportation, and asked for assistance in the shape of the bounty if they should erect a smelter to produce a copper matte containing 80% to 90% of copper. The two gentlemen making this application were Canadian born but are now residents of Michigan. The Commissioner promised consideration.

The Ontario Mining & Smelting Company, at Bannockburn, Ont., have put the new concentrating plant at work on the old dumps left by the Hollandin Company. The shaft has been retimbered and sinking resumed. The milling plant consists of a building 35'x45', into which the ore is delivered on an upper floor. After passing through rock breaker the ore is delivered to screens, from which the various sizes pass to jigs and shaking tables. The mill needs the labor of two men per shift, and handles 30 tons in the two shifts; the 30 tons of crude ore produce about 4 tons of concentrates, or a reduction of 7½ into 1. The concentrates are low in grade, owing to dump material being treated, but the tailings are remarkably clean. The vein carries about 30" of clean galena, which is cobbed out and shipped as lump ore. The blast furnace is nearing completion. All the work of design and construction has been under the direction of the Superintendent, Mr H. F. E Gamm.

Some Western Ontario papers, and a few Michigan journals, in making comment upon the troubles which have been pursuing some of the Lake of the Woods properties in the Courts and elsewhere, allude to a Mr. M. A. Meyers of Buffalo, who acted as promoter and optioned a number of mineral properties in Western Ontario, some of which it is understood were successfully floated but others of which did not enjoy as good fortune. The Big Master mine in the Wabigoon District is one of the properties which has gotten into trouble by reason of a Mr. Barron exchanging a town property for some mining stocks. Last winter, at a meeting of shareholders, it was revealed that the Big Master mine had no money in hand and a large amount of floating indebtedness. By reason of these difficulties, litigation between Mr. Meyers and Mr. Barron is already in sight. The matter is worth mentioning only as indicating how possible remunerative properties have been slaughtered and sacrificed through the grotesque ideas of promoters and men ignorant of mining business. The Jubilee mine, well known to our Ontario readers, was capitalized at the ridiculous sum of $3,000,000 and the stock sold at 10% of par, putting a valuation on this prospect of $300,000. In 1899 this same Jubilee mine was examined by a competent engineer for

eastern people, and its purchase on a valuation of $75,000 was *condemned*. Yet, by the broker and promoter, the mine was offered as a good purchase at four times the value which the engineer refused to sanction.

BRITISH COLUMBIA.

The Slough Creek Mining Company at the statutory meeting held in London at the beginning of the month voted to issue 40,000 10% cumulative preferred shares, preferred as to 40% of the profits, and redeemable at 110.

The St. Eugene mine is now working full time and has 280 men on its pay roll. Contracts with the British Columbia smelters and with Belgian ore buyers assure steady work for about two years.

The Snnset mine, at Sandon, issued its cheques for the 11th dividend at the last of May. This mine is maintaining its reputation for high grade ore shipments, the average running 140 ounces of silver and 80% lead.

The lessees of the Chapleau mine, Slocan Lake District, have struck a body of ore which assays well, and a steady run of the mill is probable. This property prior to May 1904, had been idle for three years.

The Queen Bess mine, and the Wakefield have both forces of lessees at work ; the former is working some good ore on the 5th level, the latter has not yet obtained as satisfactory conditions.

Prospectors on Cottonwood Creek, Toad Mountain, have found a ledge, varying from 18" to 40" in width, of white quartz, carrying iron pyrites and free gold. Some of the specimens are fine examples of free-milling quartz, the gold showing in large particles.

The B. C. Standard Mining Co. Ltd., owners of the "Hunter V" mine near Nelson are making regular shipments to Northport. Trail and Nelson, where the ore is used as a lime flux. It carries considerable values in gold and silver as well as a large percentage of free lime.

A discovery of a three foot seam of bituminous coal at the entrance of Wulfsohn Bay, Malaspina Strait, B.C. is announced, and licenses for nine square miles have been applied for. The coal seam has been examined by a Mr. W. Ashman who has endorsed its quality, and the large area of the field.

The Sullivan Group Mining Company of Marysville, East Kootenay, has experienced a change in its executive. Mr. Chas. Sweeney has secured an option on one million shares of the Company at 10c. per share, and will receive 450,000 sbares as the bonus for underwriting the bond issue. The total capital is 3,000,000 shares.

The average monthly output of the Boundary mines during 1904, has been about 70,000 tons ; if this is kept up for the year the annual output will aggregate 850,000 tons. The Granby mines contributed nearly 70% of the whole output, and the Mother Lode about 24%, leaving 6% for the Montreal & Boston aggregation and the smaller mines.

The Helen Mine at Greenwood, B. C. struck the vein in its crosscut on the 7th of June. The ore seam was 14 inches in width and ran high in values, the native silver showing freely in the ore taken out. It is surmised that this vein is the southern continuation or counterpart of the Elkhorn, which lies north of the town.

A dividend of ten cents per share was declared last month by the Providence Mining Co. of Greenwood, B. C. This is the third dividend earned by this mine, two of ten cents each having been paid last year. The Company's operations, though not extensive, have been successful and profitable, owing to the excellent management which has characterized it since its inception.

Advices from Rossland state that the output of the mines in that district for the week ending May 30th. was :—Le Roi 1,225 tons ; Centre Star 1,389 tons ; War Eagle 1,130 tons ; Le Roi No. 2, 350, and milled 280 tons ; Spitzee 30 tons ; I. X. L. milled 100 tons ; Jumbo 2,000 tons. The total production for the year to date is 156,942 tons.

The Gold River Mining & Power Co., which has acquired about a mile and half of river diggings on Bull River, near Fort Steele, will commence active operations on an extensive scale this month. The bed of the Bull River is reported to be rich in placer gold and the outlook is most encouraging for a large amount of development work being done during the present season.

Mr. A. B. W. Hodges, Smelter Superintendent, at Grand Forks, B. C., has been appointed the General Superintendent of the Granby Consolidated Mining, Smelting & Power Company. Mr. W. Y. Williams, former Mining Superintendent, has been appointed Consulting Mining Engineer. These changes are the result of the growth of the Company's interests at places outside of and beyond Phoenix, B. C. which necessitate the services of a mining man almost continuously.

The Slough Creek Mining Company, an English corporation who own several miles of Slough Creek, Caribou District, report that their last effort to reach the rich gravels of the lower strata has been successful. A shaft was sunk off the known underground water course, and a level driven below the low stratum known to carry gold. From this level an upraise was made to the gravel bed, and a sufficient quantity obtained to prove its richness. Work will now be directed to obtaining this gravel in regular quantity so that dividends may be assured.

The Hall Mining & Smelting Company have been making improvements about the smelter consequent upon the activity given to the lead question by the resumption of mining operations. Both stacks have been running steadily on lead ores, and will continue to do so so long as shipments are received from the St. Eugene mine.

The Davys lease on the Silver King property expires in August 1904, and the Company are not prepared to say that it will be renewed.

The Emma Iron Mine at Eholt, B. C., operated by the Hall Mining & Smelting Co. is still shipping at the rate of 130 tons per day, which are distributed to the smelters of the Boundary Creek country, to the Canadian Smelting Works at Trail, and to the Hall Company at Nelson.

The new Montreal & Boston Consolidated corporation has formed an underwriting syndicate in the persons of Messrs. Brent Good (Carters Little Liver Pills) Leach (Farwell, Leach & Co., bond-brokers) and Loomis (National City Bank), all of New York City. The shares are now being offered at 30% of par—giving a floation value of $2,250,000 to the aggregation whose nominal capital is $7,500,000. This percentage allows $1,500,000 for the purchase of the Dominion, Morrison, Athelston-Jackpot, 3/4ths Emma, $150,000 cash working capital, and syndicate's profit, and puts a valuation of $450,000 on the M. & B. smelter combined with the Sunset mine. In boom times the syndicate would make a handsome profit, but with present conditions it looks like a waitlng proposition.

The Elk River Power & Light Co., have started work at Elk River Falls, and will proceed to install a large power plant immediately, which will furnish power to all the industries in th Crows Nest Pass region. The establishment of this plant will prove to be an important factor in the development of mining in South East Kootenay, its chief aim being to supply electricity, for conversion into power and light, in connection with mining operations in the Kootenay valley. It is also the intention of this company to construct an electric railway from Elko to Michel, which will solve the the problem of cheap transporation for coal and coke, and in the event of the erection of a smelter,—which must necessarily come,—this cheap and efficient means of transportation of fuel will be one of the essentials for the successful operation of the smelter.

NORTH-WEST TERRITORIES.

Oil has been struck at Pincher Creek, Alberta. The flow amounts to three hundred barrels daily.

Advices from the Frank Mine state that over 100 men are now employed and large quantities of coal are being delivered daily to the C. P. R., who are taking the whole output for their own use. 350 tons per day were taken out of the main entry and loaded on the cars. The shaft is now down 360 feet and promises to maintain a large output.

YUKON.

A Dawson Despatch advises that the royalty paid on output to 1st of June, is the largest amount ever paid to the same date by the district. The production to June 1st is reputed as 55,753 ozs ; for 1903, the output to 1st of June totaled only 11,000 ozs.

INDUSTRIAL NOTES.

The Ottumwa Box Car Loader Co., of Ottumwa, Ia., U.S.A., whose advertisement appears in this issue, is making some progress in getting its machinery introduced into Canada, and report that its representative will spend considerable time visiting the mines during July and August. The machines introduced by this Company are proving a great success, and if, as is claimed, they greatly reduce the loading expense, and at the same time will prepare the coal in better condition for the market, they will unquestionably be much sought for by both producers and dealers.

The Canadian Westinghouse Company, Limited, of Hamilton, Ontario, have recently closed a contract to furnish the Shawinigan Water & Power Company, Shawinigan Falls, P.Q., with a 6,600 K. W., two-phase, 2,200 volt, 3,600 alternations, Rotating Field Alternator, for direct connections with water wheel. Two 2,200 K. W. Oil Insulated Water Cooled Transformers, 2,200 volt primary, 50,000 volt secondary, are included in this contract.

The Canadian Westinghouse Company, Limited, of Hamilton, Canada, has sold to the Northern Electric & Manufacturing Co. Limited, of Montreal, Que. a 300 KW. Steam Turbine unit, consisting of a Westinghouse-Parsons Turbine and a Westinghouse Turbo-Alternator. They report numerous inquiries for these units and anticipate a brisk demand for them in Canadian territory.

Machinery Hall at the St. Louls Fair is not closed in the evening, as are the other buildings, and in consequence the big 5000 H. P. Allis-Chalmers-Bullock engine which drives the electric generator is a constant source of interest to the evening visitors. This engine and generator produce the current which illuminates some 120,000 decorative lamps scattered all over the buildings and grounds.

Mr. C. C. Tyler has resigned his position as Superintendant of the Works of the Westinghouse Electric & Manufacturing Co. at East Pittsburg, Pa., and has been appointed General Superintendent of all the works of the Allis-Chalmers-Bullock interests in the United States. Mr. Tyler will make his headquarters at Milwaukee. Before Mr. Tyler went to Pennsylnania he had made an excellant reputation, and at Pittsburg he enhanced this by the results he achieved in increasing the efficiency of the Westinghouse Electric Works. In the equipment of manufactories, in the design and construction of machine tools in the handling of machinery and material, in processes of manufacture, and in fact in all that pertains to the economy of machine shop administration, Mr. Tyler is recognized as an expert. His appointment is another evidence of the care and strength by which the Allis-Chalmers-Bullock Company is being wrought together.

The St. Louis Exposition, in the Mining Division, will contain a 5 stamp mill of the exact size, weight and dimensions of a unit of the Homestake mills, accompanied by an equipment of amalgamating and cyaniding devices such as are employed by that corporation. The mill is donated by the Colorado Iron Works of Denver, Colo. and the daily cost will be financed

by an appropriation from the State of South Dakota, helped by the Black Hills Mining Men's Association. The equipment will require at least 1500 tons of ore to keep it in operation for an extended period, and contributions of ore parcels have been promised by mine owners in different localities in the Black Hills. Mr. R. P. Akin of Denver, and Mr. B. C. Cook of Deadwood will be in charge of the running of the plant, which is intended to make clean-ups twice a month. It has been suggested that the plant may be used to make test runs on outside ores, but authority to do this has not yet been granted by the exposition authorities.

Messrs Peacock Bros., the Canadian representatives of Hadfield's Steel Foundry Works, at Sheffield, England, and whose offices are in the Canada Life Building, Montreal, have sent us an interesting copy of the London Times containing an account of a recent inspection of the Hecla Works of the Company by a section of the Institution of Civil Engineers, accompanied by representatives of the British Ordinance Committee and military attaches of foreign nations. A number of projectiles which had been fired at armour plated targets were exhibited, many of which had passed through the armour plates, so that the efficiency of the cap of mild steel was well demonstrated. A 12" shell which had passed through a 7" nickel steel plate appeared none the worse, being only slightly scratched on its sides. The foundries, machine shops and other departments were visited and a number of tests made to exhibit the properties of some of the steels made by this Company. Some 15 or 16 years ago the founder of the Company, Mr. Robert Hadfield, held the opinion that cast steel could be used, not only for *common* shells, but also for armour piercing shells, which view was opposed to the opinions of metallurgists and artillery experts of that day. The British Government authorities however encouraged Mr. Hadfield to proceed with his experiments, with the ultimate result that tests made by the Hadfield Company's steel projectiles showed that the same were suitable for perforating wrought-iron and compound plates. The Hadfield Company, however, have given attention to means of defence as well as of attack, and have recently produced a plate for the protection of mounted guns which possesses some unusual qualities. It is made of cast steel of a special description, to which the name "Era" steel has been given. At a test a $4\frac{7}{10}$" armour piercing shell, fired at a velocity of 2100 foot-seconds, was successfully resisted by one of these plates 6" in thickness. The same plate resisted a 6" common shell and 6" lyddite shell, and was only partially pierced by a 6" armour shell having a velocity of 2039 foot seconds, and a striking energy of 2880 feet tons. A Krupp cemented 4½" plate under similar tests was completely broken up. The tests made on armour plate have disproved the long maintained contention that to produce trustworthy articles it is necessary to put mechanical work on the metal, that is to say, that the metal must either be forged or rolled. The fact that the Hadfield Company have been able to produce cast metals which have achieved such results as these is striking and full of significance. The means by which the Hadfield Company have achieved their results are, of course, secret and held as one of the assets of the business. The public is informed however, that the success of the Hadfield Company's steels is due to the result of chemical research into the action of minute differences in proportions of the different alloys of iron, and also to the subsequent special heat treatment to which the material is subjected. Among the other exhibits at the Hecla Works which were shown were castings for tramway and railway work for both rolling stock and permanent way. The rapid wearing action to which points and crossings are subjected have led to the same being manufactured of manganese steel by the Hadfield Foundry. This steel being both hard and tough has a very great resistance to wear and tear, and at the same time is not brittle, as would be the case with ordinary high carbon steel. The advantages of this metal for points and crossings, which are subjected to strain and shock to a very high degree, will be at once appreciated by engineers. The only difficulty with manganese steel which is presented is its hardness, which prevents its being machined, since no steel tool will cut it. Therefore it must be cast into whatever shapes or dimensions are required. The works of the Hadfield Company cover some 80 acres, and the steel foundry is one of the largest in the world, covering alone 6 acres. Over 4000 men are employed in this establishment.

ELECTRICAL NOTES.

ELECTRIC MOTORS FOR MINING WORK.—One of the questions that is agitating the engineering side of the mining world at the present time relates to the best form of electric motor for use in mines. The continuous current motor has done very good service, and thousands of that type are in use in mines all over the world, driving mining plant of all kinds; but recently, since the advent of the three-phase motor, the continuous current machine has fallen somewhat into disrepute. The continuous current motor has a commutator, while the three phase motor has none, also, the continuous current motor has the whole pressure of the service (usually 500 volts) in the revolving portion. While the rotor of the three phase motor has only approximately one-tenth of the pressure of the service, so that with a three phase machine there is less danger of shock, and a better chance for effective insulation. For small motors also, especially where the motor can be started without any load, the rotor (the moving part of the apparatus, the part corresponding to the armature in continuous current machines) need have no connection with the outer circuit, nor with any other part of the machine itself, while with larger apparatus the arrangements for starting against a load, are less liable to break down, or to sparking, or heating, than those used in connection with continuous current motors. Hence it is not surprising that three phase motors are making the running. When they were first introduced there were prophecies as to what would happen in mines if they were used, and the non-happening of the things prophesied has set the pendulum swinging rather violently in the other direction. The three phase apparatus is very useful, and very simple, and will probably be found to be more suitable for many situations in mines. Its adoption must be made with the eyes open, however. Three cables have to be used in place of two, and though this is not a serious matter, it is as well to remember it when drawing the balance sheet between the two. A more serious matter is the fact that a large current has to be generated uselessly, owing to the fact that in alternate current work, the pressure and current are rarely in unison at any instant. The actual power given to a machine being known, the useful power is found by multiplying the current and pressure together, and then multiplying this product by a fraction which is rarely more than 0.8, while the full current has to be generated, just as if it was usefully employed. This leads to another drawback. In starting any motor, the current taken for the starting period is very large and the drop in pressure is great in proportion; with three phase apparatus this is very much accentuated, owing to the fact of the current pressure not acting together, and it is, therefore, found difficult to keep the pressure constant at both unless the generator is very much over its work. The generating capacity at the mine ought to be well in excess of its work, as one can never know when some extraordinary accident may happen, and if the capacity is to the requirement, the mine may have to stop through failure of power, while if it is well over its work the mine may be kept going till the matter can be attended to. There is another point, in the three phase motor the revolving part runs very close to the stationary part, and this leads to stoppages from very slight causes; this can be overcome by care, or by sacrificing a certain part of the efficiency of the apparatus.

THE TURBO-ELECTRIC SYSTEM IN MINING WORK.—The Newhouse Mines & Smelter Company, has adopted Westinghouse steam turbines and electrical apparatus for furnishing the power for mining operations in Utah, and for local lighting. Mining operators have but lately awakened to the advantages of the turbo-electric system for securing economy in mine operations, and the Newhouse plant will be of interest in this particular field. A notable precedent has already been established by the adoption of turbines of the same make by the DeBeers Mining Co., Limited, South Africa, where two 1,000 K. W. Westinghouse-Parsons turbines are already in operation and a third is under construction.

The Newhouse Mines & Smelter Company's new power station is at the terminus of the Oregon Short Line Railroad, twelve miles from Frisco, Utah. Power will be generated at 440 volts and transmitted at 2,300 volts, a distance of 9,000 feet from the power plant to the mines, where it will be stepped down to 400 volts for the motors in the concentrating mill situated at the mouth of the tunnel. Power will also be used to drive a motor generator set for the operation of mining locomotives in the main tunnel. The entire electric system is a 3-phase with a frequency of 7,200 alternations per minute.

The generating plant consists of two 400 K. W. Westinghouse-Parsons turbines with 3-phase generators of like capacity. The turbines will operate under 150 lbs. steam pressure, 27" to 27½" vacunm, and approximately 80 degrees Fahr. superheat at the turbines. An individual surface condensor will be provided for each turbine. The boiler plant will consist of three 280 H. P. Babcock & Wilcox boilers to carry steam at a pressure of 155 lbs. with superheater at the boilers of 100 degrees Fahr.

The plant is being erected and equipped under the charge of Robert F. Moser, M.E.

The Mining of Antimony.

Twenty years ago antimony was discovered in Nova Scotia. The location of the ore is at Rawdon in Hants County. A few years ago this property was acquired by Mr. A. McNeil of Halifax, and others, who, under the name of the Dominion Antimony Company, have spent a great deal of money in development work with very encouraging prospects. This shaft is about five hundred feet down, and one thousand feet of levels have been made. The ore carries considerable quantities of gold as well as antimony. A thirty-ton lot of ore recently shipped to London gave a return of $50 per ton in gold, and this is a fair representation of the ore found on the property. The old owners of the property years ago took about 3,000 tons of ore from the mine, which was treated for antimony only. If that ore contained the same proportion of gold as the recent shipments these people threw away about $150,000.

The most important question that has now to be solved is the treatment of the ore at the mine. Not very long ago it would have been said that the gold could not be extracted from such an ore as this, but at the present time there are two companies in England buying gold in antimany ore—and it will not be long before a plant for ore reduction will be established at the West Gore Antimony Mines, which will be the most interesting yet introduced into this province. The company now employs 40 men at the mines. The opening of the Midland Railway is of great assistance in the development of this district.—*Hants Journal, March 1904.*

Comparative Statement of Importation of Mining Machinery.

	1902.			1903.		
MONTH.	*Free.*	*Dutiable.*	*Total.*	*Free.*	*Dutiable.*	*Total.*
January....	$ 92,984	$ 2,549	$ 95,533	$ 77,298	$ 7,676	$ 84,974
February ..	43,123	2,380	45,503	30,106	1,587	31,693
March	55,225	2,629	57,884	83,535	11,534	95,069
April	61,227	5,087	66,314	104,967	4,638	109,605
May	90,820	4,782	95,602	155,493	1,469	156,962
June.....	77,270	5,293	82,563	155,387	6,579	161,966
July	47,511	2,171	49,682	128,730	4,737	133,467
August	90,798	1,139	91,937	105,838	3,119	108,957
September..	82,090	8,906	90,996	89,463	6,086	95,549
October....	57,011	4,040	61,051	110,570	1,641	112,211
November ..	56,292	9,395	65,687	106,897	9,498	116,395
December..	45 359	1,677	47,036	60,489	11,710	72,199
	$799,740	$50,048	$849,788	$1,208,773	$70,247	$1,279,047

Yukon Gold.

The gold yield from the Yukon, from 1st July, 1903, to 29th February, 1904, was $7,101,243.42, on which royalty to the amount of $179,982.20 was was collected. In 1903 the Government expended on roads and bridges in the Yukon, the sum of $310,818.91.

The gold exported from Canada in 1903, was $16,437,328.00.

Coal.

	Tons	Tons
Nova Scotia:		
Cape Breton	3,719,400	
Cumberland	593,475	
Pictou	697,743	
Other Countries	234,629	
		5,245,247
British Columbia		1,659,741
North West Territory		609,765
New Brunswick		15,000
		7,529,753

Coal Trade.

Bituminous, mined in Canada		7,529,753
Bituminous and Anthracite imported (Great Britain 97,784.)	161,822	
Australia and Japan	11,931	
United States, 3,642,296, 1.394,675	5,036,971	5,210,724
		12,740,487
Less exported to		
Great Britain	25,335	
United States	1,719,029	
Newfoundland	126,669	
Other countries	108,920	1,979,951
Total consumption of coal in Canada in 1903		10,760,526
Total consumption of coal in Canada in 1902		9,218,272
Increased consumption in 1903		1,542,254

What NOT To Do.

Mr. Lyman White, State Commissioner of Mines for Colorado has issued a code of "dont's" to be posted at the mouths of shafts and tunnels in that State.

Mr. White's action is doubtless prompted by a knowledge of the recklessness bred by the "contempt of familiarity," which marks the action of most miners. In the following code there are no new "don'ts" but the idea is to refresh the memories of the miners, and perhaps attract their eyes at the very moment of going under ground.

"Don't get on bucket without first seeing that safety chain is properly hooked.

Don't get on cage or bucket without first signaling the engineer. Give three bells, then get on cage or bucket, and ring one bell to hoist or two bells to lower.

Don't ride on loaded cage or bucket.

Don't ride on cage or bucket containing tools, timbers or explosives.

Don't load steel or timbers without first landing car or bucket.

Don't attempt to get on or off cage or bucket while in motion.

Don't leave guard rail thrown back.

Don't get in a hurry in signalling engineer, space your bells.

Don't work in ground you consider dangerous; call your foreman's attention to the condition of the ground.

Don't be careless, thereby endangering the lives of your fellow workmen.

Don't drill in an old hole or "gun."

Don't fail to thoroughly examine ground for missed shots before starting to drill, whether any misses are reported or not.

Don't attempt to pick out a missed shot.

Don't store explosives in excess of one day's supply under ground, but in magazine provided for that purpose.

Don't use steel or a metal rod of any description for tamping."

It is not wisdom to think too well of one's self, but Canadians may certainly be pardoned if they have such a mental attitude when they read the numerous paragraphs, appearing from time to time in the American Press, which are commendatory of the order which prevails in the Yukon Territory as contrasted with the moral and political disorder obtaining at Nome, in Alaska. Nome has no representation in the Councils of the great Republic, no public buildings, no wagon roads constructed at the State's expense, and no police system worthy of the name: in the last four years the administration of Justice at Nome has required the successive efforts of three judges, while at Dawson, one judge has held his position for seven years. The difference in conditions is not so much due to the different political systems under which the Government of the two sections are administered, as to the efficiency of the officials who are in charge of the administration of law and justice.

A sample of gold from near Dawson, Yukon Territory, analyzed by the provincial assay office, yielded 390 milligrams of osmiridium to the ounce of gold.

European investigation of the effect of rock drilling upon the health of machine drill men has resulted in the development of valuable statistics dealing with death rates among such workmen. In the Transvaal a commission reported that four of 1,210 men examined, 15.4 per cent. were clearly affected, and 7.2 per cent. were suspected cases, rock drillers contributing 91.98 per cent. of the infection. Exposure to mine dust is held mainly responsible for this condition of affairs, the investigation showing that dust and not mine gas was the direct cause of the mortality, miscrospic examination of the rock particles showing them to be serrated and sharp. It is also reported that the rock drill miner's task is hazardous out of all proportion to other mining employment, at the same time pointing out that the added risk of occupation may be almost entirely eliminated by the use of water and that "in quantities so slight as to probably cause little danger of fostering ankylostomiasis" In the United States little attention has been paid to this question of mortality and its causes, it not being generally the practice for miners to return to their levels almost immediately after shots are fired.

The Mines and Metallurgy Building in the Philippine section of the St. Louis exhibition is nearing completion, and will have an elaborate display of minerals, geological specimens and fossils found in the Island, together with models of primitive and modern mining and reduction plants used by the natives. The exhibit is in charge of Mr. Roy Hopping.

CANADIAN MINING INSTITUTE

Incorporated by Act of Parliament 1898

AIMS AND OBJECTS.

(A) To promote the Arts and Sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications.

(B) The establishment of a central reference library and a headquarters for the purpose of this organisation.

(C) To take concerted action upon such matters as effect the mining and metallurgical industries of the Dominion of Canada.

(D) To encourage and promote these industries by all lawful and honourable means.

MEMBERSHIP.

MEMBERS shall be persons engaged in the direction and operation of mines and metallurgical works mining engineers, geologists, metallurgists, or chemists, and such other persons as the Council may see fit to elect.

STUDENT MEMBERS shall include persons who are qualifying themselves for the profession of mining or metallurgical engineering, students in pure and applied science in any technical school in the Dominion, and such other persons, up to the age of 25 years, who shall be engaged as apprentices or assistants in mining, metallurgical or geological work, or who may desire to participate in the benefits of the meetings, library and publications of the Institute. Student Members shall be eligible for election as Members after the age of 25 years.

SUBSCRIPTION.

Members yearly subscription.....$10 00
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PUBLICATIONS.

Vol. I, 1898, 66 pp., out of print.
Vol. II, 1899, 285 pp., bound red cloth.
Vol. III, 1900, 270 pp., " "
Vol. IV, 1901, 333 pp., " "
Vol. V, 1902, 700 pp., " "
Vol. VI, 1903, 600 pp., now in press.

Membership in the Canadian Mining Institute is open to everyone interested in promoting the profession and industry of mining without qualification or restrictions.

Forms of application for membership and copies of the Journal of the Institute, etc., may be obtained upon application to

THE SECRETARY,
Canada Permanent Building, TORONTO, Ont.

Ontario's Mining Lands..

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite : copper in sulphide and native form ; gold, mostly in free milling quartz ; silver, native and sulphides ; zincblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1900 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe. The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc , apply to

HONORABLE E. J. DAVIS,
Commissioner of Crown Lands,

or

THOS. W. GIBSON,
Director Bureau of Mines,
Toronto, Ontario.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

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Commissioner Public Works and Mines,
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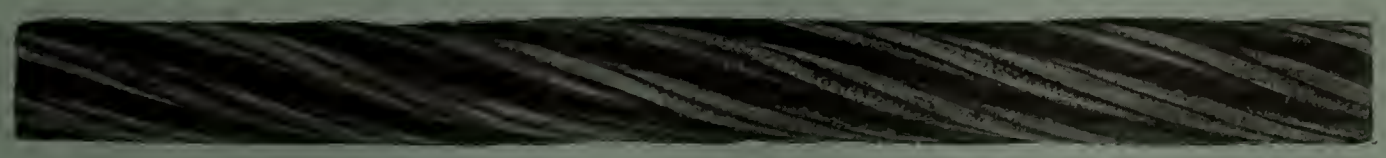

Illustration of ¾" diar. Special Improved Patent Steel Wire Rope, 1760 yards long, supplied to Dalzell Colliery, Motherwell, Scot., which ran two years and 8 months, shewing condition when taken off. Previous rope from another maker lasted 1 year and 9 months

TELEGRAMS—"Ropery Rutherglen. A B C, A I and Lieber's Codes used.

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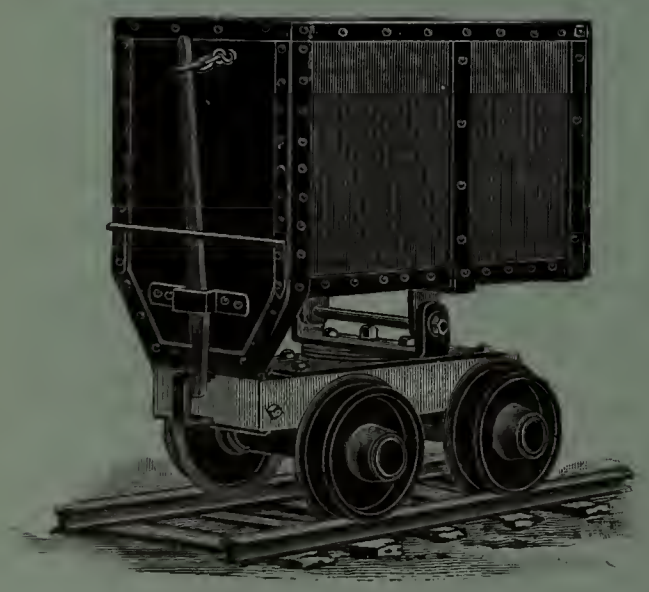

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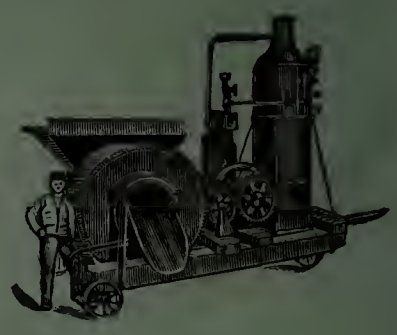

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TWENTY-SECOND YEAR OF PUBLICATION

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Established 1882

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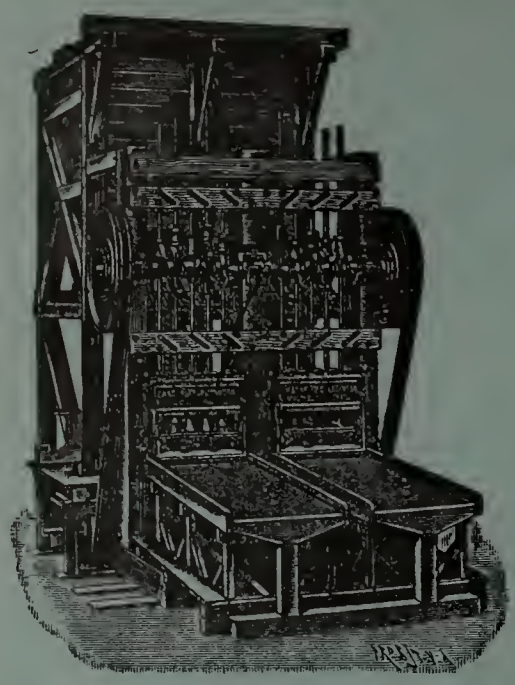

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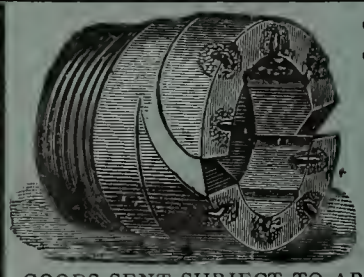

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Ontario's Mining Lands..

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite: copper in sulphide and native form; gold, mostly in free milling quartz; silver, native and sulphides; zincblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1900 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe. The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc, apply to

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The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles aud the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mlning of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction or 100 ; if the mine is on Crown lands (1) in unsurveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at th mine of the mineral extracted after deducting the cost of mining it.

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Dominion of Canada

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be aquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee, $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank. but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be obtained within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one-half per cent on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200.

A certificate that work has been done must be obtained each year: if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior,
OTTAWA, February, 1904.

JAMES A. SMART,
Deputy of the Minister of the Interior.

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Established 1882

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The REVIEW PUBLISHING CO., Proprietors | PUBLISHED MONTHLY. | Office: Orme's Building, Ottawa.

VOL. XXIII., No. 7. | JULY, 1904. | VOL. XXIII., No. 7.

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Advertising copy must reach the REVIEW Office *not later than the 15th of each month* to secure insertion in current issue.

CONTENTS.

ANNOUNCEMENT.

Announcement is made to our subscribers, contributors and advertisers that the offices of The Canadian MINING REVIEW have been removed to No. 157 St. James Street, Montreal, P.Q. The REVIEW and MINING MANUAL passed into the hands of the Review Publishing Company, Limited, about a month ago, in which corporation the heirs of the late Mr. B. T. A. Bell are the controlling shareholders. All communications should be addressed as above.

In consequence of the interest shown in and the increasing importance of, chemical and metallurgical work the REVIEW opens a chemical notes column this month to which all chemists and metallurgists are invited to contribute accounts of their experiences, methods, doubts, apparatus and conclusions in the investigations carried on in their laboratories.

The promise made to the shareholders of the Crow's Nest Pass Coal Company at the last annual meeting that the Great Northern Railway would be extended from Morrisey to Fernie this season is being fulfilled. Contracts have been let for 9¼ miles of construction which will connect the two towns. A branch line 5 miles in length has to be built by the Coal Company from Fernie to the mines up Coal Creek, and when this work is completed the Company will have competing transportation and Mr. J. J. Hill will have realized his project of direct communication with the most valuable coal field in the West. The effect on the fortunes of the Coal Company should speedily be felt in an increase of their American trade. Having glutted the B.C. market they must, in order to maintain a profitable output, ship largely across the line. This can only be done over the Great Northern Road, as the C.P.R. cannot give advantageous rates to Montana and Washington points because of the transfer involved. Trade has been slack in the Fernie District this season in consequence of lessened demand. As soon as these railway connections are completed there is no doubt the Great Northern can keep all the Crow's Nest mines busy. This outlet is all the more necessary in view of the rapid development of production in the Blairmore and Banff districts, the whole of which is absorbed in the Canadian market.

The action of the B.C. Government with reference to the coal and oil lands in East Kootenay is not turning out as satisfactorily as was expected. The decision to raise the price of a license from $50 to $100 and to give no guarantee of title, but to leave more than 200 claimants to fight out the issue in the courts, has so little attraction for bona fide locators that so far as can be learned not a single application has been made for a license, and as no one seems disposed to move, the Government finds itself minus the expected revenue from the issue of several hundred licenses and with an unsolved problem still on its hands. As there is no scarcity of coal the Province can afford to await the progress of events, meanwhile the only sufferers are the speculators and promoters who hoped to reap a rich harvest from new flotations.

There are many reasons why oil lands should be classified apart from coal lands and separate licenses issued just as in the case of mineral claims. It would greatly simplify matters if this were done in B.C. In the case of the Flat Head district, careful work done by the Geological Survey has located practically all the valuable coal. The existence of oil in economic quantities is entirely problematical, but can be determined by deep boring on a few isolated locations. The instances are rare where a deep hole would not settle the question over an area of many square miles—why then should this entirely distinct project be complicated with the acquisition of coal lands? If licenses were granted (say, at $100 each for an oil claim 1,500 feet square) without reference to coal or other mineral it would meet all the requirements of the case and greatly cheapen the cost of prospecting.

It is not always that the relations of a Manager are equally cordial with his employers and his workmen—when such is found to be the case it is worth noting. Mr. T. R. Stockett who, three months ago, was appointed General Manager of the Crow's Nest Pass Coal Co. has just resigned to accept a similar position with the Western Fuel Co. at Nanaimo. This is the Company which recently took over the New Vancouver Coal Company, managed so successfully for many years by the veteran Mr. S. M. Robins. Mr. Stockett has been with the Crow's Nest Pass Co. for nearly four years in various capacities and on leaving was banquetted and received valuable tokens of good will from the Directors and workmen. That he is fully entitled to them we can readily believe affer reading his modest speech in which he paid a frank tribute to his pioneer predecessors who had "blazed the trail."

In pursuance of the policy initiated two years ago the C.P.R. are proceeding with the development of coal areas at various points in the West and North-West, the object being to ensure an adequate supply of steam fuel for their own use. Their most important works are at Banff, where several seams of semi-anthracite coal are being rapidly opened up. It is expected that by the spring of next year an output of 1,000 tons a day will be attained. The requirements of the Company in Manitoba and the North-West will shortly be supplied from the Bienfait Mines in Assiniboia, and during the present season much development work is being done in the Nicola coal field, from which it is the intention to supply the main line and branches from Revelstoke to the Coast. The requirements of the Kootenays will probably be met from the sections recently ceded to the Company by the C.N. P. Coal Co. at Hosmer, about eight miles north of Fernie. It is not unlikely that, at the latter point, coke will also be manufactured for the Canadian smelter at Trail. How far these extensive operations may be checked by the activities of private enterprise remains to be seen, but it may be taken for granted that the C.P.R. will not be caught napping again in respect of an abundant supply of cheap fuel for both themselves and the industries which they serve.

Concerning the Lead Bounty in B.C.

In its last issue the REVIEW printed a telegram from Mr. Alfred C. Garde, President of tne Associated Silver-Lead Mines of B.C., which requested the withdrawal of the statement that the smelters, either directly or indirectly, obtained part of the bounty on lead, and which advised the REVIEW that an explanatory letter for publication had been mailed. We then regretted that this letter had not been received before going to press, and expressed our willingness to publish, and our hope of commenting upon, all facts relevant to the matter; the letter came to hand on the 5th of July and appears in another column of this issue.

Our comment upon the facts pertinent to this subject follows.

It is not proposed to discuss smelter rates, since that question is complicated to the uninitiated and involves many factors affecting the cost of smelting which are dependent upon the quality of the ores treated, their varying composition and the changing conditions of transportation and market; rates are only mentioned as leading up to some reasons which have been advanced why the smelters *should* participate in any bonus granted.

Some time in the year 1899 the Western smelters realized that their lead bullion was sold abroad on the basis of the London market price, with the exception of such small part (not exceeding 10%) as the U.S. Government allowed to be retained free of duty, and that their charges were really based on the relation of the London price to the New York price, and and that the payments were also based upon the same relation. They knew that this was unsatisfactory to themselves and in consequence, the representatives of the smelters independent of the trust Everett, Selby, Trail and Nelson, met in St. Paul in December 1899 to discuss matters, and to propose that the market to govern the buying price should be the market which governed the *selling* price, *i.e.* London. At that meeting the basis of payment and settlement for Canadian ores was changed to the London quotation, and, instead of making a deduction on account of the duty (as had been done on the basis of the New York price) there should be made an arbitrary deduction from the London price to cover costs of transportation of bullion to the refinery, the refining charge, transportation of pig lead to its market, the marketing charges, and leave a surplus out of which would come such extra charges as might not be fully covered by the original $20 per ton for cost of freight and smelting, and also leave a margin for profit—this arbitrary deduction got to be known by the name of "marketing charge", which misnomer has persistently clung to it to this day. In the REVIEW'S opinion it is due, in no small measure, to the failure of the smelting companies to disclaim this phrase that mine owners have been led to believe that it covered up a multitude of sins on the part of the smelting companies, and really represented a large profit for the smelter.

In January 1900, therefore, the B.C. Smelters' charges were fixed at "$20 per ton for freight and treatment, and a deduction of 70c. per 100 lbs. of lead contained." Under this

basis the ore was sold, not alone to the "independent" smelters but also to the American Smelting & Refining Company, familiarly known as the "Trust", which alone bought in that year between 15,000 and 20,000 tons of ore, and paid for all of it on the new basis of London prices.

In the following year, 1901, the freight and treatment charge was reduced to $19 per ton but the deduction was raised to a rate of $1 per hundred pounds of lead.* In the second year thereafter (1902) the freight and treatment charge was reduced to $15 per ton (at which price it has remained to the present time), and in 1903 the rates were still further bettered by increasing the zinc limit to 10% instead of 8%. Other conditions, of perhaps minor importance, were also imposed such as making the settlement due ninety days after the receipt of the ore by the smelter; producers complained of this condition on the ground that they had to accept all the fluctuations in the market price during that period of three months, if the price advanced of course the producer obtained a bigger sum, but as the price at that time was steadily decreasing the complaint that the smelters were getting a little the better of the producers was apparently well sustained. We believe that as to these facts there is no possible denial.

In 1901 the Canadian Smelting Works at Trail installed a new Dutch process for the refinement of lead, and justly obtained from the Government a bounty on lead refined in Canada. This bounty started at $5 per ton for the first year and decreased by $1 per ton, each year, until it was extinguished. In the meantime matters for the lead miner instead of getting better rather got worse, and an agitation began in 1902 for the securing of a bounty upon all pig lead smelted or produced in Canada from Canadian ores. This culminated in 1903 in the granting by the Government of a bounty at the rate of ¾c. per lb. on *lead produced* in Canada from *Canadian* ores, and was made payable to the owners of the ores; under this Dominion Act payments of large amounts were made a month or two ago by Mr. G. O. Buchanan, acting as the disbursing officer of the Government for this purpose.

Although this bounty was of very great value to the mines producing high grade ore it did not help out the producer of low grade ores to a similar extent, and the largest producer in the Province closed down in 1902 and remained closed until this year when agitation was begun early in the year to obtain a bounty, or an application of the existing Bounty Act, to such Canadian lead ores as might be exported to foreign smelters. This agitation was perhaps originated by the smelters, who asked the Silver Lead Mines Association, at a meeting held in Nelson in March, to guarantee them an annual supply of 40,000 tons of lead ore or else be prepared to accept an increase of the freight and treatment rate to $17 a ton, the figures named being, as before, based on a 40% lead ore. The feeling of the mine owners at the Nelson meeting was that, even with the present bounty, those mines which produced only *low grade* ores or concentrates could not make a profit, and that therefore to meet the minimum tonnage required by the smelters would require strong and vigorous action on their part in the shape of a counter-blast. Therefore a New York ore buyer, Mr. Ehrenzoller, was brought forward by a representative of the St. Eugene mine and openly offered to take 50,000 tons a year for export for two years, at a freight and treatment rate of only $8 per ton. It has been commented (with what truth the REVIEW is unable to state) that this offer was a pure bluff and made as such, and intended to influence the smelter representatives. If this was the case it was certainly successful, since the smelters met the bluff promptly by making a counter proposition to take the entire output of the mines of East and West Kootenay, irrespective of quality, if the mine owners would join them in endeavoring to have the surplus of the existing bounty in each year made applicable, pro rata, to the surplus ores which the smelters could not at present take care of and which they would themselves export.

This counter proposition occasioned many conferences between the smelters and the miners, and it was at the time of these conferences that the writer, whose editorial communication appeared in our April issue, put forward the statement that the smelters were directly obtaining a percentage of the bounty. From Mr. Blakemore's letter, which we print on another page, it appears (according to paragraph 6) that during these conferences the miners and smelters agreed that if the readjustment were effected it would be fair for the miners to benefit to the extent of 60 % of the bounty granted, and the smelters to the extent of 40%. Doubtless this discussion is what our writer had in his mind when he was rash enough to make the statement that the smelters obtained 75% of the bounty, and, so far as our investigations have gone we freely admit that this proposition, discussed as it were *in camera*, is the *only* basis upon which there is any evidence of facts to support this contention.

In view of all the facts recited, and of numberless other ones which the REVIEW has received and has not space to publish, it makes the explicit statement that, it was *not* justified in publishing the statement that the smelters received 75% of the bounty, and that statement is *herewith explicitly withdrawn* and our apology to the smelting companies offered. Whether the smelters *desired* to obtain a portion of the bounty (as might appear from the paragraph in Mr. Blakemore's letter and other items which have been communicated to us) and were afterwards willing to abandon that project is not pertinent to the purpose of this article: it is evident that at the present time they have no direct interest in the question.

EDITOR.

*Mr. Blakemore's statement that a $15 rate was made in 1901 is an error.

The Carbonization of Peat by Electricity.

A new utilization of the electric current in an economic direction is reported from England, where Messrs. Johnson and Phillips, in their works at Charlton in Kent, have used electricity for the conversion of peat into a fuel having a calorific value of 9,000 B.T.U. The points of attraction in the process are two:—

(1) The conversion is accomplished without the loss of

any of the heat-producing hydro-carbons, which are always destroyed in attempting the coking of peat by fire, and no conditions of weather affect the operation of the process.

(2) The low cost of conversion, which is stated not to exceed $1.20 per ton of fuel obtained.

The process, in brief, consists in first packing the cut peat into large rotary iron cylinders, which are a form of centrifugal dryers. These cylinders are rotated at a high speed, and, with the assistance of beating arms arranged on the interior of the cylinder in such a way as to both beat the peat and turn it over, something over 95% of the contained water is expelled. The cylinders are then brought to a standstill and wires are attached to cups on the exterior, by means of which a large current of low voltage is sent through the peat which remains in the cylinder; electrodes being permanently arranged on the heads of the cylinders, and connected with the wires through the cups before mentioned.

The passage of the current through the mass of peat meets with high resistance, thereby causing heat, which, in time, carbonizes the organic matter and converts it into particles of black carbonaceous matter which retain all of their carbon.

After carbonizatin the cylinder is emptied, and the carbonized matter is fed to machines which break it up, mix it with a binder, and press it, either into the form of briquettes which are then left to harden in the atmosphere, or it is made into large masses which are afterwards broken up and screened to sizes required.

This new form of peat fuel is said to give great satisfaction, leaving little ash and forming no clinkers. A plant for the conversion of 100 tons of peat per diem is stated to cost $20,000, and the cost of manufacture to be $1.20 per ton of fuel produced.

Results, of course, are dependent upon the cost of the electricity at the peat bog; at the works at Charlton the electricity was generated by steam power, so that the cost would manifestly be less if water power were available. The process is worthy of the closest examination by our Ontario and Quebec friends who have been struggling with the peat industry.

Present Sentiment Towards Mining.

We publish in this issue a letter and a contributed article, both of which are indicators of the sentiment at present prevailing in Canada towards mining. With the views expiessed in our correspondent's letter we are in accord, for nothing (probably) has been more characteristic of the general Canadian attitude towards mines and mining than the gambling in shares which has been so much in evidence during the last six years. Capitalists, merchants, professional men, clerks, parsons and women have all bought mining shares to get money quickly, and have, each and all, talked as if they were "in mining," or as if their money was. There is nothing more certain than that less than 25% of the money paid for mining shares ever saw the mine's bank account.

We need not remind our readers of War Eagle, Centre Star, Big Three, Montreal & London, etc., etc., ad nauseam. People bought their shares because induced to do so by the people who had them to sell, and also because they trusted to some one, a Hosmer, a McCuaig, or a Blackstock, to make money for himself, and each man thought himself smart enough to get out as quickly as any of the "big" men—today they better know their nimbleness.

Not one of the victims of the last six years bought because he *personally* believed in the investment, or because he personally investigated the merits of the property. Nor were these victims eager to accept the advice of engineers who *had* investigated and *did* know. Instead, they seemed rather to see red and black only, and if red came up they felt satisfied to pat themselves on the back, and think themselves quite "financial sharps," but when black came up (as it did in the end most frequently) then anathema—maranatha was his cry—someone had "done" him—poor fool! he had "done" himself.

Mr. Brown's clear exposition of the lack of brains in most mining schemes is in a soberer tune, but his statements are deadly facts. His encomiums upon the management of the Brookfield are well deserved.

We commend perusal of M. W. G.'s letter and Mr. Brown's article to those of our acquaintance who have "been up against it."

The Late Frederick Siemens.

Advices from Berlin announce the death of Mr. Frederick Siemens, the eminent German scientist and manufacturer, in the month of May of this year. Mr. Siemens was in his 78th year, and was born at Menzendorf near Lübeck in 1826. Frederick Siemens was the third and last survivor of four brothers who together constituted one of the most remarkable families Germany has known, all of whom became famous in the worlds of science and of industry.

Werner Siemens, the eldest of the brothers, was a highly distinguished electrician, and one of the founders of the well known electrical engineering firm of Siemens & Halske. The second brother, Sir William Siemens, the most of whose life was spent in England, was the founder of the Landore-Siemens Steel Works. The youngest brother, Hans, founded the glass works at Dresden, which Frederick took over in 1867 when the youngest brother died.

It was Frederick Siemens who originated the open hearth furnace and process which, today, is producing both in Great Britain and on this continent a large percentage of the total steel tonnage. He sought and effected a combination with M. Martin whereby the Siemens-Martin process became established. An important stage in its progress was the invention of the regenerative furnace which, although founded upon the researches of Sir William into the theory of heat, was nevertheless primarily the idea of Frederick, who carried out the regenerative principle in the simplest manner and applied it directly to ordinary fuel consuming furnaces.

Frederick Siemens was not as well known in England as his brother, Sir William, for he rarely appeared at meetings of the Iron and Steel Institute, or at functions of a similar character. It is probable that no invention connected with the steel industry has been of more solid value than that of his open hearth furnace.

CORRESPONDENCE.

Payne Consolidated Mining Company, Limited.

PAYNE MINE, SANDON, B.C., June 27, 1904.

TO THE EDITOR.

SIR :—Referring to your editorials in April and May issues of the MINING REVIEW, I note your statement that Canadian smelters in some cases have obtained over 75% of the $15 bounty granted by the Dominion Government per ton of lead mined and smelted in Canada. I believe that I understand the situation between the Associated Silver-Lead Mines of B.C. and the smelters fairly well, but confess that I am at a loss to understand how you can substantiate the above statement. As you probably know, I am in no way connected with the home smelting industry—contrary—hereto my interests are on the other side—having mined and for several years contracted for a considerable tonnage of silver-lead ores. I should be in a position to speak authoritavely on the subject, and can assure you that the Canadian smelters since the granting of the bounty have not enjoyed any benefits from same except so far as an assurance of a steadier and larger tonnage of ore favors a lower cost of operation.

With the particular view of avoiding complications the Government granted the present bounty to the miners direct, and as a matter of fact it was not until the Canadian smelters relinquished their claim on the then existing refining bounty that the Government would consider the question of bonusing the lead industry at all. It will have to be admitted that this action was a sacrifice on the part of the smelters. The refining bounty starting at $5 per ton for the first year was granted in 1901 for a period of five years on a yearly reducing sliding scale of $1 per ton and was in reality a smelter bonus. On the strength of same the Canadian Smelting Works at Trail invested a considerable sum of money for erecting works for the refining of Canadian lead ores, and when the new lead bounty act took effect last year there still remained in force three years of the former bounty.

It is in my opinion only fair that this statement should be made public in justification to our friends in the smelting business. There have been times when our views differed materially, but I am pleased to state that for some time past the Associated Silver-Lead mines and the home smelters have been working in harmony. On several recent occasions we have joined hands, and the lead mining and smelting industry of British Columbia has thereby been benefitted, as clearly pointed out in your April editorial.

In conclusion I may state that the entire adjustment of the lead bounty is in the hands of Mr. G. O. Buchanan, Government Inspector of Lead Bounties in British Columbia. No claims for bounty can therefore be honored until verified by him. Our experience at the Payne Mine has fully demonstrated this feature. No one but the party mining the ores can therefore enjoy the benefits of the bounty. This feature combined with the fact that freight, smelting and marketing charges have remained unchanged since January 1st, 1902, will explain that the smelters are, neither directly nor indirectly, participating in the bonus, the sole advantage gained by them being the assurance of an increased tonnage and steady supply of ore.

Hoping that this will throw some further light on the question,

I beg to remain,

Yours very truly,

ALFRED C. GARDE,

President, Associated Silver-Lead Mines of B.C.

[See our editorial on the "Lead Bounty" in this issue.—EDITOR.]

Mining vs. Share-Peddling.

TO THE EDITOR.

SIR :—

It may be confidently asserted that more fortunes have been made in actual legitimate mining than in any other form of investment ; while it may also be asserted with equal confidence that more people have been ruined by purchasing picturesquely printed mining certificates than by any other form of indiscriminate gambling. There is a vast difference between investing in a mine and dealing in mining shares, yet the most curious and conspicuous feature of the game is the utter inability of the business man to recognize and appreciate this distinction. Experience apparently counts for nothing. One glib-tongued peddlar in shares is succeeded by another, one failure is followed by another failure, the public is the perennial prey and the game goes merrily on.

To the practical mining expert there is nothing more astounding than the eagerness displayed by sound business men to buy mining shares at 10 or 20 cents on the dollar ; while it is equally astounding to observe the difficulty in interesting business men in a legitimate mining proposition. Nineteen business men out of twenty will prefer to buy pretty mining certificates at ten cents on the dollar from the smooth-talking peddlar who is, as a rule, absolutely ignorant of real mining, rather than invest an equal amount of money in prospecting or developing under expert and reliable advice and guidance. In the former case the business man has repeatedly written his cheque unhesitatingly, and rarely asked for expert advice ; in the latter case he will haggle about terms, demand a large controlling interest and, as a rule, wholly fail to appreciate the value of expert testimony. In other words, he will readily give his cheque to a peddlar in shares without asking for control, or haggling in any way, but he will not give his cheque for an equal sum to a thoroughly reliable and efficient mining expert to test or examine a property which the practical man tells him is really worth the venture.

This is the most curious and incomprehensible feature of the game. By investing from two thosand to five thousand dollars in a prospect under the advice of a competent and reliable mining expert, a small syndicate of business men would stand a reasonable chance to make a fortune, an excellent chance of obtaining large profits, retain control and secure the working capital required by placing shares at par with their friends ; but by giving $2,000 to $5,000 to the share peddlar in exchange for showy certificates, which may represent a hole in the ground, and frequently not even that, there is practically no chance of a return at all. It is, of course, attractive to get a pretty certificate marked "Par value $1.00" for 10 cents, but it should not be forgotten that 10 cents will really pay for the printing of ten certificates and the concern disposing of the certificates at 10 cents really make a very hand-

some profit. If the business man is very anxious to buy pretty certificates I should strongly advise him to print his own—he will get them much cheaper.

The most unfortunate feature of this unfortunate method which is unfortunately so fashionable is that, it has a tendency to discredit mining and retard the development of the industry. I frequently hear business men say "Don't talk to me about mining—I am through with it. Never made a dollar yet at it,"—when the fact is clear that he never had a dollar invested in a mine. He has simply been the prey of the share selling shark and has been dealing in certificates and not engaged in legitimate mining at all.

When the business man will apply the same rules and the same common sense to mining that he has applied to his own business, he will be equally successful.

Yours truly,

MONTREAL, July 13th, 1904. M. W. G.

The B.C. Smelters and the Lead Bounty.

TO THE EDITOR.

SIR :—In consequence of the conflicting opinions expressed in the columns of the REVIEW on the above subject, I have made the fullest inquiries as to the existing arrangements between mine owners and smelters, and summarize the results as follows, first stating the facts as briefly as possible, and then making my own inferences :

1. When trade was at its worst in 1901 a $15 freight and treatment rate was granted by the smelters with a sliding scale attached entitling them to $1 additional for every £1 increase in the price of lead in the London market above the basis of £12 per ton.

2. In 1902 the zinc limit was reduced from 10% to 8%, an additional penalty of 2% against the producer.

3. In 1903 the zinc limit was again raised to 10% where it still remains.

4. In 1903 the sliding scale clause was abolished and the charge for freight and treatment made constant at $15.

5. In. 1903, in consequence of representations made by Mr. Retallack (representing the lead miners) that the $100,000 bonus granted by the Government for the establishment of a lead refinery in Canada stood in the way of the bounty being granted it was voluntarily surrendered by the smelters.

6. In 1903 it was mutually agreed between the mine owners and the smelters that, if the bounty were granted, it would be fair for the former to benefit to the extent of 60% and the latter 40%. and some plan was to be devised to achieve this end.

7. In the spring of 1904, pursuant to the above, it was contemplated to raise the rate from $15 to $17. This was discussed between the parties interested and ultimately abandoned in favor of joint support to the petition for applying a portion of the bounty to exported ore.

8. The smelter charge to-day is therefore actually lower than at any previous time, since the standard rate is the minimum $15, the sliding scale which permitted an automatic increase is abolished and the zinc penalty has been improved to the extent of 2% in favor of the producer.

The inferences to be drawn from the foregoing facts are as follows :

1. That there has been no increase in any branch of smelter charges either for freight, treatment or marketing since the lowest figures were established.

2. There has been a reduction represented by a more favorable adjustment of the zinc penalty, equal to about $1 a ton, and a further concession in the abolition of the sliding scale.

3. The smelters derive no benefit whatever from the bounty either directly or indirectly except from the increased tonnage available for treatment as a consequence of the support accorded to production of lead ores.

4. The smelteres have voluntarily relinquished the bonus of $100,000 granted for a refinery and the Canadian Smelter is erecting works for the manufacture of lead pipe and sheet lead without government assistance.

5. Having had an opportunity of examining all the returns and documents necessary to verify the above statements and conclusions I am convinced that any charge that the smelters are sharing the bounty, or that they are crippling the lead mining industry, can not be substantiated and would not be concurred in by the producers themselves.

W. BLAKEMORE, M.E.

NELSON, July 14th, 1904.

Mica Deposits.

By FRITZ CIRKEL, M.E.

(Continued.)

As to the general occurrence of mica deposits, especially in the Ottawa valley, from a great many observations the writer may state that speaking in a practical sense two different deposits may be distinguished, that is first, the vein-like deposits forming the contact between pyroxene rock and gneiss, and second, pockety deposits occurring either at the contact between diorite and feldspar or wholly in pyroxene.

The former are the most important for mica mining, inasmuch as the mica can always be traced and followed along the line of fracture or the solid walls of the gneiss formation, horizontally as well as in depth. A good example of this mode of occurrence is the Wallingford mine at Perkins Mills, P.Q., and the property belonging to the Wakefield Mica Co., on lot 16, third range of the

FIG. 11—Vein in the Wallingford Mine, Perkins Mills, P.Q.

township of Wakefield ; also the once famous Lake Girard mine in the same township. Thes deposits have been worked downward, along the contact with the gneiss, for over 250 feet as at the Lake Girard, and there is no doubt that if operations at the latter mine were continued in depth that considerable quantities of mica could be found just as in the upper levels. The vein-like deposits are the most desirable from a mining point of view, the mica being deposited, as mentioned above, near the line of fracture, or mostly near a solid wall, and in spurs or branches leading from the main deposit, can easily be traced or followed and in nearly all cases little dead rock separates the depositions of the mineral. Calcite is a frequent companion of mica in these vein-like deposits, and the presence of this mineral, on account of its contents of mica crystals of mostly perfect quality, is looked upon with favor by miners. The question has often been raised whether mica deposits go down in depth, and whether the quality of the crystals would improve or diminish in depth. As above outlined, the occurrence of mica has much in common with that of phosphate deposits and as the latter have been mined to a depth of over 700 feet and seem still to be continuous there is no reason to suppose that the occurrence of mica is of superficial character.

The amount of dead rock, and consequently the risk, in vein-like deposits is reduced to a minimum while systematic developing

FIG. 12—Vein in the Rhéaume Lake Mine, Gore ot Templeton, P.Q.

work, preparing the mine for a large output, can be pursued more easily.

As to the second mode of occurrence—that in pockets near small dikes of diorite and feldspar, or wholly in pyroxene—it must be stated that, although some good mines of this class, like several properties at the Cascades on the Gatineau River, have been discovered and yielded a large output, their mode of occurrence, on account of the uncertainty and the risk involved, is less desirable than that of the vein-like depositions. Many mines of this class contain splendid deposits of large size, and the general occurrence of the latter resembles a chain of lenticular bodies, extending towards the depth as well as horizontally, but the dead rock and the absence of any leading indications between the deposits render their detection very difficult, and this is the main reason why we hear so much of a mica mine giving out. This is also the cause why the underground work of a mica mine belonging to this class is of such a twisted and irregular shaped character, and resembles so very little the methodic mining seen in lode mining. The mica generally follows certain lines of faults or fracture, forming occasionally stringers or narrow veins, splitting up or converging into each other and forming a larger accumulation. It is also frequently observed, near the contact with feldspathic or dioritic rocks, that the pyroxene formation holds a great many boulders of a dark feldspar mixed with quartz, sometimes merging into a granite, and that between these boulders mica

FIG. 13.—Vein in the Battle Lake Mine, Township of Templeton.

crystals are imbedded in a matrix of a soft, and pale green pyroxene, giving the whole a cob-webbed appearance. Cavities are frequently met with, sometimes of very large dimensions, lined with mica crystals or crystals of pyroxene, and apatite. The quality of the mica generally found in cavities is very fine, as the crystals seldom show a lateral disturbance in their foliation and possess all the qualities demanded for a commercial product.

Very often we find that a deposit contains a very small percentage of useful mica, that almost the whole body is made up of shattered, contorted and twisted mica crystals—sometimes also of micaceous rock matter. This condition is apparently brought about by disturbing influences, either by the shifting ot the adjacent formation, or by a sudden change in temperature during the process of the formation of these crystals out of Ha_c heated magma which filled the fissures from below.

As to the color of phlogopite mica we have all shades from the black variety up to the lighter shades, the silver or amber being the most frequent. The very dark, or nearly black, varieties as chemical analysis has shown, contain sometimes a large amount of iron and for this reason their application to electrical purposes is restricted. The lighter shades are generally obtained from soft, pale green pyroxene ; where the latter is dark and hard the mica appears to be harder also and the color darker. There are

also greenish and pink shades, but these varieties are rare in phlogopite species.

As regards the occurrence of apatite in association with mica, we can discriminate, although there are exceptions, between three different regions in the country north of Ottawa, (1) the Lievre District ; (2) the Templeton District ; and (3) the Gatineau. In the Lievre District, that is in the country north of Buckingham, the deep phosphate mines for the greater part show the occurrence of very large apatite deposits to a depth (as at the "High Rock" and "North Star" mines) of 1000 feet and over, while mica in connection with this mineral is rarely met with. Wherever the latter is associated with apatite, the mica crystals generally are brittle, break up, or are contorted and twisted, and the quality of

Fig. 14.—Vein in the mine of the Wakefield Mica Co., Limited, Township of Wakefield, P.Q.

the phosphate is seriously impaired. In the Templeton District, and more especially in the pyroxene belt around McGregor Lake, we find mica freely associated with apatite and the crystals met with are perfect and of sound condition. In the Phosphate King mine near Perkins Mills a very fine crystal measuring 18 inches in diameter, was found in solid apatite, while at the Wallingford mine in the immediate vicinity the mica in association with phosphate is amongst the best found round the mine. Another example is the Blackburn mine, where large masses of clean, high grade phosphate are occasionally met with in association with mica deposits of considerable extent. The occurrence of a pink calcite is one of the characteristic features in connection with mica and phosphate in the Templeton area, the calcite very often replacing the apatite and carrying good mica crystals of commercial value. The Gatineau District is distinguished from the others by carrying a larger amount than usual of calcite in the pyroxene, and while the latter may at times hold in connection with mica large crystals of phosphate, still it is seldom that the latter can be worked profitably. There are exceptions to this rule but taken as a whole the district under question offers very little encouragement for the profitable mining of apatite in connection with mica.

On account of the great irregularity and variation of occurrence, surface indications are not sufficient to give a judgment on the value of mica deposits, as many prove of superficial character; all outcrops on the surface must be explored to depth before any definite idea can be gained as to extent and quality. In many cases we find that the humus covering the solid rock contains a considerable amount of mica sheets or fine laminæ, especially on mountain slopes or small ravines, and much money has been spent in the effort to find the mica in the solid rock—but often in vain. This is due to the weathering and decomposing process of nature ; all crystals on the surface undergo decomposition by the time the sheets are loosed, separated, split up in fine laminæ—and all, or part of them, carried away by the action of water and deposited in places lower than the outcrop whence they came, and sometimes far away. Thus it comes that we have an apparently large deposit of sheet mica and decomposed crystals in the soil, while we find nothing in the underlying rock. In examining a mica property, therefore, the uninitiated is betrayed by this sporadical occurrence of mica and gains the impression that the property so examined is really a very desirable one, whereas it contains perhaps deposits of little or no value, or even might contain nothing at all.

As to the quality of the Canadian phlogopite or amber mica, its fitness for electrical or general domestic purposes is so well known that it is not necessary here to go into this at length. In comparison with the East India mica the Canadian product seems to hold its own and in several respects is even superior. The late Dr. George Dawson having sent samples of the Canadian phlogopite mica over to London with the object in view to determine their commercial value and the possibility of an extension of trade in the United Kingdom, Professor Wyndham Dunstan, M.A., F.R.S., Director of the Scientific and Technical Department of the Imperial Institute, reported as follows :—

"General physical and chemical examination showed that the "samples were uniform in character, pliable and softer than much "of the mica which appears on the English market. In order to "ascertain its commercial value, especially its fitness for electrical "purposes, the samples were submitted to one of the largest "electrical manufacturers in London, and also to one of the largest "mica brokers in the city.

"The electrical manufacturers report that the mica is suitable "for a variety of electrical purposes. On the general question of "the uses and comparative value of the Canadian amber mica the "brokers remark that this variety of mica is of no value other "than for electrical purposes, its special value being principally "due to its softness and easy lamination. They are of opinion "that Canadian amber mica is of greater value for electrical work "than most of the Indian mica that comes to this country. They "remark, however, that there are two or three varieties of Indian "mica, such as White Bengal, Cochin from the west coast of "Madras, and Ceylon amber mica which compare very poorly "with the Canadian product, whilst the selling prices of these "Indian varieties are often from one third to one half those asked "for the Canadian mica. They confirm the opinions expressed in "Dr. Dawson's letters of February 16th and April 4th, (1901), "that Candian miners obtain a better price in the United States "than in the London market chiefly from the circumstance that "American electricians prefer the Canadian product, which is close "at hand and can be depended upon for uniformity of quality and "regularity of supply."

Although circumstances point to the United States as being the natural outlet for Canadian mica, nevertheless it would be worth while to take steps to make it better known in the British

market since there are several factors operating against the Indian product, especially the matters of tariff and regularity of supply.

As to the chemical composition of phlogopite mica, it must be assented that the latter, in order to be use for electrical appliances, should contain very little iron. In the following table are analyses from different specimens.

	Mica from North Burgess.	Mica from Templeton.	Mica from Perth.	Biotite Mica.
Silica.....	40.97	40.00	39.66	39.5
Aluminum..	18.56	17.00	17.00	16.5
Magnesia..	25.80	26.50	26.49	22.00
Potash.....	8.26	10.00	9.97	——
Soda.....	1.08	——	0.60	——
Iron.....	——	0.50	0.47	8.5
Volatile....	1.00	3.00	2.09	4.00

From the above table it appears that the mica obtained from some localities in North Burgess is the purest, as it contains no iron. In one of the analyses from this localityy the mica was decomposed by heated sulphuric acid, and in another by fusion with carbonate of soda. The alumina contained no trace of iron. The mica from Templeton and from Perth comes next, containing only 0.47 and 0.50% of iron—while black phlogopite (perhaps biotite) taken from a property on the Lievre River contained as much as 8.5% of iron, rendering the same entirely unfit for use for electrical appliances.

The question whether a mica mine pays or not is concentrated in the form. "What is the lowest percentage of commercially useful mica sheets in the rock mined, in order to make a mine pay." To answer this question we must discriminate between open quarry work, which is generally carried on in large pockety deposits and during the summer months only, and under ground workings in vein-like deposits of a cob-web or cavity nature are mined, the quantity of rock to be hoisted is generally very large. Experience in different mines of this class has shown that with present prices at least 1,000 lbs. of mica of all sizes, from 1″ x 3″ up, trimmed, must be taken out for every 100 tons of rock under ordinary circumstances in order to pay for all mining expenses including management and to leave a good profit besides. As to the underground mining, the quantity of rock hoisted for a given quantity of mica is not so large since mining is more or less confined to the narrow shafts and drifts following the course of the mica veins or lenticular deposits. Experience in this direction shows that under ordinary circumstances at lest 2,000 lbs. of trimmed mica must be raised for every 100 tons of rock mined—the depth of the shafts not exceeding 300 feet—in order to pay for all current expenses, including management, and to leave a good profit besides. The run of mine (that is the rough mica crystals, as they come from the pits and are delivered to the cobbing sheds) is of course much larger, in some cases it is as high as ten times the commercially usetul quantity ; in good paying mines, however, the run of mine should not be more than from four to five times the quantity of trimmed mica. In other words, in the case of an open quarry mine about 2½ tons of run of mine—yielding at least 1,000 lbs. of all sizes, and in the case of underground workings about 5 tons of run of mine—yielding at least 2,000 lbs. of all sizes, should be extracted for every 100 tons of rock in order to make a mine working under ordinary conditions pay all expenses and leave a good profit. There are exceptions to the above, but generally speaking the above figures represent the experience in many mica mines of the Quebec Division.

As to the yield of the different sizes in the run of mine, of course it is diffiicult to give figures as a basis of calculation, as this depends solely upon the character and quality of the deposits mined. Some deposits yield only small mica, with a very small percentage of larger sizes while others—but they are not so frequent—yield a comparatively large percentage of the larger sizes. Generally the mica of commerce is trimmed to the following sizes : 1″ x 3″, 2″ x 3″, 2″ x 4″, 3″ x 5″, 4″ x 6″, 5″ x 8″ and over, and under "large sizes" is commonly understood a mica cutting 4″ x 6″ and over. One mine in the Wakefield Township yielded with a certain regularity

61% of..... 1″ x 3″
26% of..... 2″ x 3″
9% of..... 2″ x 4″
3% of..... 3″ x 5″
1% of..... 4″ x 6″ and over

A mine which delivers exceptionally large sizes is the Battle Lake mine in the Templeton Township. This mine yielded since the beginning of operations, which consisted mostly of open quarry work :—

36% of..... 2″ x 3″
27% of..... 2″ x 4″
20% of..... 3″ x 5″
17% of..... 4″ x 6″, 5″ x 8″ and over

Generally speaking a deposit of fairly good quality should yield as an average about 50% of 1″ x 3″, 30% of 2″ x 3″, 10% of 2″ x 4″, 6% of 3″ x 5″, and 4% of 4″ x 6″ and over.

The prices paid for the different sizes of course fluctuate a great deal and much speculation is manifested amongst mica dealers. However, the following table gives the prices paid at present by a large firm :—

Size 1″ x 3″ 12 cents per pound trimmed (not cut)
" 2″ x 3″ 25 " " " "
" 2″ x 4″ 35 " " " "
" 3″ x 5″ 65 " " " "
" 4″ x 6″ 90 " " " "
" 5″ x 8″ $1.10 " " " "

In this connection it may be interesting to learn that Sir William Logan in his report of progress for 1863 mentioned a sale of mica in London of several hundred weights of large selected crystals : "Taken from a locality north of Burgess, and fit for splitting into thin plates, at two shiilings the pound, while from four-pence to seven-pence were given for inferior qualities. There was also a large demand for smaller sizes of mica and for the refuse portions from its workings. These among other uses were employed in making letters for window signs. Ten shillings a hundred weight were lately offered in London for fifteen or twenty tons of such material."

While up to 1898 the larger sizes mostly were saleable, a much larger demand has now sprung up for the smaller sizes, 1″ x 3″ and perhaps 1″ x 2″ owing to the rapid progress in the art of mica insulation for electrical apparatus. Instead of using large sized mica, the fine sheets of smaller size are now moulded and cemented together into so called "micamite" practically a mica board—and by this new and very practical invention the natural crystals are almost entirely replaced. This micamite or board is made by building up layer after layer of the thinnest mica sheets, moulded or coated together by cement or shellac and then subjecting the whole to hydraulic pressure. The boards are generally about 3 x 4 feet square and 1 inch thick, and can be sawn up as desired. The fact that the smaller sizes may now be utilized

places many mica mines in a most favorable position ; nearly all deposits, as shown above, produce a very large percentage of small mica, while the output on the larger sizes in many mines is very small or practically nil, and as there appears to be a steady market for the smaller sizes the existence of a mica mine is attended with less difficulties, and its life prolonged.

On account of the irregular character of most of the mica deposits the methods employed to work a mine are manifest. The easiest work and the one which requires little or no systematic preparation is the open quarry—where several deposits or pockets are mined together until the rock in situ show no more mica. The disadvantages of this method are obvious ; no work can be performed during the winter on account of the rigid weather, while in many cases where the deposits are not rich the hoisting and removing of so much dead material is a cause of great expense. Working underground has therefore many advantages, the principal one being the possibility of continuous operations. In the case of a vein-like deposit, with a solid hanging or foot wall a shaft is usually sunk on the latter, and the deposit opened up at intervals of 30 to 50 feet by side drifts and subsequently by upraises and winzes. The mica so laid open is then stoped whenever desired. Occasionally pillars are left supporting the walls and roofs in the drifts. Of course this system of working cannot always be strictly followed especially in a case where the deposits to be mined are those of the second class above referred to, that is of a pockety, highly irregular character ; the natural outcome of such a working system is a combination of unusually wide shafts, and excavations of a highly irregular shape. The machinery employed is of the usual type, consisting of boilers, double cylinder hoists and solid gallows-frames over the shaft mouth ; usually little water is met with in mica mines and a small pump fills the requirements. Cages are not employed, the hoisting of the mineral and dead material being done in buckets sliding on skids in inclines or swinging free on guides in vertical shafts. Only in one mine in the Quebec Division, where quarry mining to a depth of 200 feet is going on, are cable derricks in use ; the preference of these over all other hoisting machinery lies in the fact, that the area covered for hoisting is very large, while mining can be carried on simultaneously at many points of the quarry. Dynamite is used an an explosive, but not to such an extent as in lode mining on account of the care to be exercised in blasting down the mica crystals ; shots loaded too heavily may destroy the quality of the mica. The principal mica mines are situated in the country north of Ottawa in the Province of Quebec, and near Sydenham and Perth in the Province of Ontario. The first large mica producer was the once famous Lake Girard Mica System, which operated the Lake Girard Mine in the township of Wakefield, the Pike Lake and Martha Mine in North Burgess, and different other properties. The Lake Girard mine attained a depth of 210 feet ; an inclined shaft of 75° was sunk on the foot wall of a large and well defined vein-like deposit ; drifts on both sides were run in order to test the same, and for several years the mine yielded a large quantity of mica. In 1893, when the writer made an examination of this property, the daily output for three months amounted to 4.6 tons of roughly cleaned mica crystals with an average number of employees daily of 48.6. For nine months the daily output was 3.18 tons with about the same number of men. All the rough mica was transported from the mine to Ottawa, a distance of 22 miles, where cobbing and cutting sheds were erected for the preparation of the mica for the market. About 70 persons were employed in this factory ; from September, 1891, to July, 1893, the total output amounted to 113,000 pounds of mica cut to size, 109,545 pounds of trimmed mica, all sizes, and 1,250 tons of rough mica cutting, 1″ x 3″. At that time this smaller mica was not saleable, the larger sizes being mostly in demand, and although the mines delivered a very large percentage of larger sheets, still it was difficult to satisfy the demand for the latter. This, in connection with the difficulties encountered in locating new deposits on the east side of the shaft, towards the latter part of 1893 prompted the management to suspend operations. Since that time the mine has been worked intermittently and it is reported that some fine deposits have been opened up and mined. The Wallingford Mica Mining Company is working the Wallingford mine near Perkins Mills, and the Battle Lake property, both situated in the Township of Templeton. The Wallingford mine has been a steady producer since its discovery in 1893, and up to October, 1896, when the writer made his first examination of this property 472 tons of trimmed mica were shipped from the mine. The output per month averaged 12 tons, with an average number of men employed of 19. It must be mentioned, however, that the small mica, cutting less than 2″ x 3″ not being saleable, was thrown into the dump, which of course represented a very valuable asset when the large demand for the smaller sizes was created. The main deposit of the Wallingford mine forms a vein, striking in an east-west direction with solid hanging wall dipping to the south. It has been mined and developed for a length of over 400 feet and to a depth of 200 feet, yielding an appreciable amount of apatite also. The mine is equipped with a modern machinery plant of large capacity, and is prepared for a large output.

The Battle Lake property is remarkable on account of its production of large sized mica. Since the beginning of operations 17% of the total output was in sizes cutting 4″ x 6″ and over, one crystal weighing 200 lbs. cut 14 x 19 inches while another one gave sheets measuring 19½ x 27 inches. Mining operations are carried on, near the lake, on a system of parallel deposits, which so far have shown to be continuous both in depth and horizontally. One shaft follows a vein of mica near the contact of pyroxene with gneiss ; this vein sends out spurs and branches, which are again divided by boulders of a hard pyroxene and granite. The mica from this property is remarkable for its fine appearance and cleavage. About fifty men are employed on both properties.

The Rheaume Lake Mine in the Gore of Templeton is working with a force of twenty-two men on a vein-like deposit. This deposit resembles the vein worked in shaft of the Battle Lake mine in sending off branches and spurs of mica, which are divided by large boulders of a garnetiferous granite. Apatite of a high grade quality is met with in connection with the mica and it is likely, judging from many indications, that both mining for mica and apatite can be worked together advantageously.

The Blackburn mine in the Township of Templeton is one of the largest producers of mica. The property comprises some 900 acres of phosphate and mica lands. The mine up to 1893 was worked for apatite only—since then more especially for mica ; the depth of the main shaft is 225 feet the size of the large open cut is 200 feet by 100 feet, and 60 feet deep, with numerous drifts and crosscuts. The mine employs about 50 persons, is equipped with a large machinery plant and with heavy cable derricks. The Wakefield Mica Company has a shaft sunk to a depth of 165 feet on the hanging wall of a well defined vein with a strike of 40° east of north and a dip to the east of 65°. The vein consists of calcite, micaceous matter and mica crystals, to some extent intermixed with phosphate (apatite). The same is developed and partially

opened up for a length of over 300 feet and has delivered large quantities of commercial mica sheets. Owing to liquidation operations are suspended.

Another large producer is the Lacey mine near Sydenham, Ontario. The main shaft has reached a depth of 140 feet on an incline of 84° to the north-east, while drifts to the east and to the west are opening up the mica deposits for a length of over 140 and 75 feet respectively. Two other shafts have been sunk of 40 and 30 feet depths. The mine is equipped with a first-class machinery plant. The roughly culled mica is sent via Sydenham, to the mica trimming works of the company at Ottawa. About 50 persons are employed at the mine.

The Vavassour mine comprises a mica lot in the Township of Hull, Que., and although it has not been a steady producer, it is remarkable by reason of the number of outcrops of mica which can be seen all over the property. These outcrops appear to be parts of several parallel veins striking through the property in an east and west direction, and it is reported that over 2,000 feet of these mica veins can be traced in the prospecting ditches and excavations which have been made. One vein is opened up for seven hundred and fifty feet by seven shafts, the deepest being 100 feet.

Other companies largely interested in mica mining are the Canadian General Electric Company, the Laurentian Mica Company, and W. Webster & Co., all of them with headquarters at Ottawa.

Concerning the production of muscovite and phlogopite mica all over the globe as alredy mentioned—India ranks foremost amongst all producers, then come Canada, United States and Brazil. The world's production of the mineral, and the number of persons employed, for 1902 is given in the following table :

Year 1902	Tons.	Value.	Persons employed.
India	1,685	$507,770	9,219
Canada	445	242,310	675
United States	180	98,859	325
Brazil and other countries	110	55,200	200
	2,420	$904,139	10,419

Notes on the British Columbia Zinc Problem.

By Alfred C. Gardé, Sandon, B.C.

Paper presented at the Sixth Annual meeting of the Canadian Mining Institute, March, 1904.

In submitting the " Zinc Problem of British Columbia " as a topic for discussion, I desire to state that I have been encouraged in doing so by observing the keen interest manifested by the Silver-Lead miners and others in determining the best methods for treating and handling the extensive bodies of zinc-blende found in ledges as well as deposits, over a considerable section of the province.

I shall be only too willing to admit that this subject, on account of its importance and certain complicated features, deserves to be dealt with by a more experienced pen than mine. I expect that this, in due time, will be done, but in the meantime, I believe that a starting effort would not be out of the way, for even the best authority would find it to be an endless task to suggest the proper remedies unless all features of the subject had been clearly described. In some instatces I have been obliged to draw conclusions from unsettled conditions, and these will no doubt be subject to change when a more definite base is reached ; at the same time, I hope that the members of the Canadian Mining Institute, including my friends in British Columbia who are particularly interested in this matter, will bear in mind that this treatise is the first one to appear in Canada on the subject and that all records and data, therefore, had to be collected chiefly by personal observation. If I should succeed in pointing out the principle characteristic elements and be permitted to offer the following notes for discussion, my present object will be achieved and I venture to hope that the initial step towards the eventual solution of this most interesting problem will be thereby taken. The features involved are as much of an economic as a technical nature, and I have mentioned elsewhere that a great many of them can and will be overcome by individual efforts of companies operating in British Columbia. After wrestling with the zinc problem, single handed, for more than a year, the Payne Mining Company under my management decided to erect a special zinc dressing plant, and are now in a position to produce from 200 to 300 tons of desirable zinc concentrates per month. Markets for the various products have also successfully been established both in Europe and the United States, and steady shipments are now being made. Since then the other companies have followed suit and there are a number of zinc shipping mines on the list now. Besides, several of the old mills are now being reconstructed with the view of treating their zinc ores on a commercial scale which points favorably towards an increased production of this useful mineral.

History of Early Adversities.

In order to clearly understand the present situation in British Columbia it will be necessary for me to relate briefly the early history of the Ainsworth and Slocan districts, being the first mining divisions in West Kootenay to record discoveries of zinc and lead. Both districts came into prominence approximately twelve years ago on account of their remarkably high grade ledges of silver-lead ores. Zinc-blende was also found in ledges and in association with galena, but for ten years not the least regard was paid to the economic features of zinc. Only in one instance a certain Mr. Brown, of Manchester, in 1899, undertook to send an experimental shipment of 1800 tons of zinc-blende from the " Lucky Jim," mines near Sandon to one of the zinc smelters in England. The assays of this shipment average 50% zinc, 3% lead and 6 ozs. in silver, per short ton. Unfortunately, Mr. Brown died in England before the shipment reached its destination, and his well intended project came to grief with him. I have not the least doubt that if he had had an opportunity to carry out his plans, our zinc ores would have had an established market five years ago. Since then the " Lucky Jim " mine fell back into obscurity ; however, it is well worth noting that this property has recently been secured by local parties for a large cash consideration, and is now generally regarded to become one of the largest producers of zinc-blende in the Slocan. The chronicle of this mine as well as the assay values of shipment mentioned will illustrate better than can otherwise be explained, how entirely the zinc industry in British Columbia has been overlooked and also what may be expected from it in time to come. It may possibly be argued that in the upper ore zones extending towards the crest and along the surface of the mountains, only a small percentage of zinc was found to be associated with the galena. This feature, however, can readily be explained as caused through corrosive action of surface water and exposure to the elements whereby the sulphides of zinc (and to quite an extent the sulphides of lead) were changed into carbonate ores. The carbonates with average contents of 80 ounces of silver, 40% lead and low in zinc, furnished an excellent smelting product on which the smelters did not impose any zinc penalty.

In several of the mines familiar to me the carbonates and galena ores free from zinc extended to a depth of 4 to 500 feet below the apex of the mountain, but by degrees a material percentage of zinc-blende made its appearance. In most cases under my observation this transformation would take place gradually, although I am aware of numerous instances where the zinc-blende has replaced the clean galena abruptly and vice versa. The result of the steadily increasing percentage of zinc was that the lead smelters found it necessary to place a penalty of 50 cents per unit on galena containing more than 10% of zinc. This penalty was accepted by the high-grade mines of Sandon who were in a position to ship a galena product averaging from 80 to 90 ounces in silver, and 45 to 50% lead. As an instance I might quote that during 1900 the Payne mine shipped 10,411 tons of galena averaging 83.79 ounces in silver, 45% lead, and 15% zinc, and that the penalty paid on zinc alone during this year amounted $28,203.42, being equal to a deduction of $2.71 per ton of ore shipped. Other mines had similar experiences and found that the zinc contents, in spite of close hand-sorting, could not be kept within the 10% limit, and that different means would have to be resorted to in order to keep the galena free from excess zinc. To overcome this difficulty mechanical concentration by water was eventually applied. A number of 100 ton mills generally driven by water power, and nearly all constructed on the same plan, were built in a comparatively short time. Hartz jigs with two, or sometimes three cells, were used in separating the coarse galena from the waste rock as well as the zinc-blende and iron, all of which went through the tail-races. For the finer lead products, buddles and Frue Vanners were used. The system of concentration employed often left much to be desired as to efficiency, but the point of keeping the galena contents within the zinc penalty limit was gained. From the above it will readily be seen that one of the essential features of concentration in the Kootenays was to send as much zinc through the tail races as possible, and it must be admitted that this aim was carried out to a high degree of perfection. The tonnage of zinc thus wasted was immense, and its extent will probably never be known ; it can only be roughly estimated from assays of the tail products which would often exceed 30% zinc and rarely go below 20%. A considerable amount of silver contained in the blende also went into the various creeks with the tailings, but so as not to get myself into hot water, I prefer not to quote any assays. In summing up the various losses, we have :—

1. Direct loss to the mines due to zinc penalty payments.

2. Loss of zinc values in smelting lead ores high in zinc.

3. Loss of zinc and silver values run to waste through the tail races of the various concentrators.

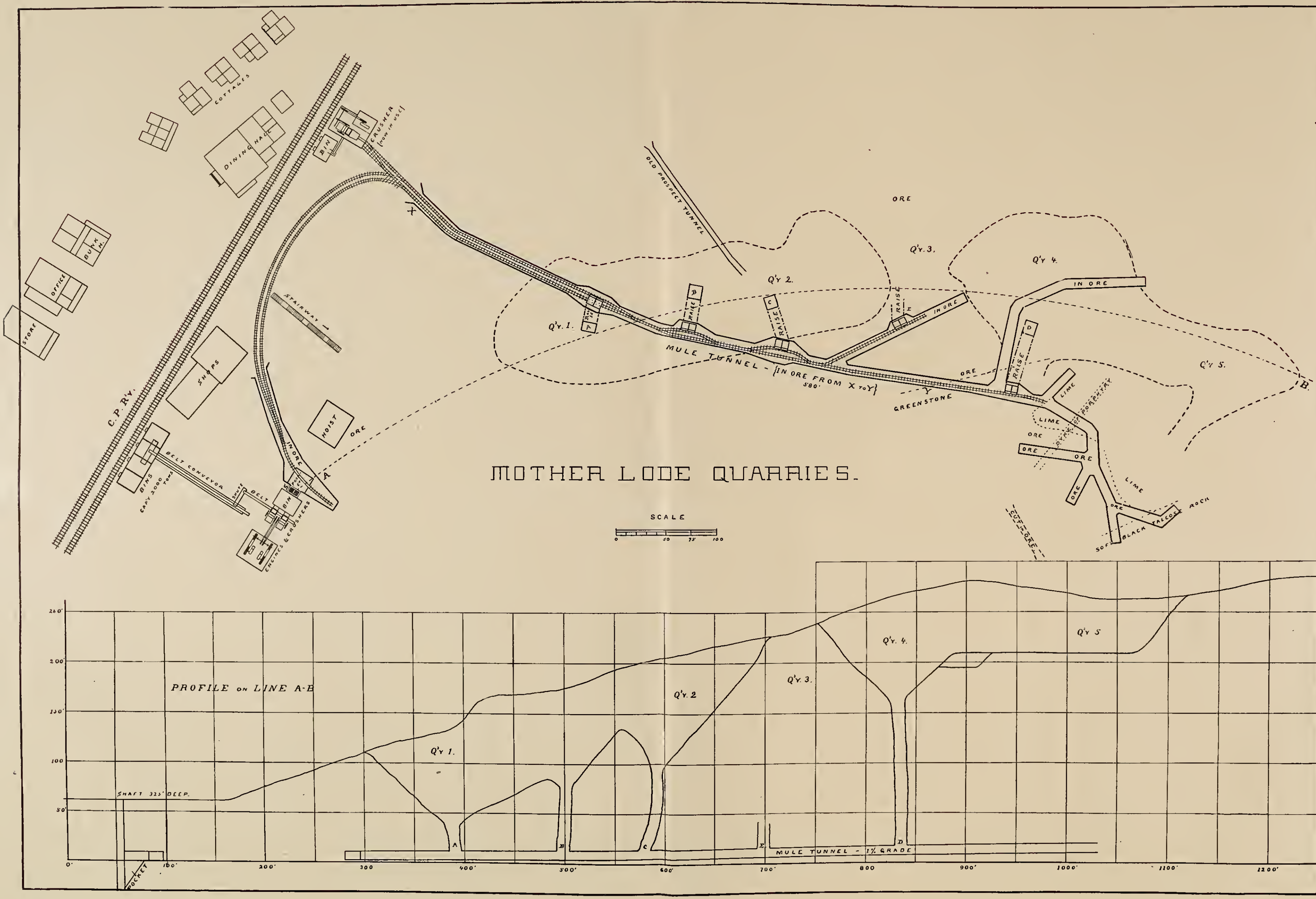
4. Hand-sorted zinc ores left on the dumps or in the old mine stopes.

Of the above losses the fourth item is the only one that can partly be recovered providing the material is present in sufficient quantities to permit of economic handling and concentration. At the Payne, the Ruth, the Ivanhoe, the Wakefield and the Alamo Concentrators, this is being done successfully now. Furthermore, the Slocan Star, the Washington, the Jackson, the Monitor, the Rambler, and several other well known properties are now preparing to alter their present plants or erect new ones whereby they will be able to recover the "zincy" material on hand, as well as all zinc that in the regular course of mining is broken down with the lead ores. In order to give an idea of results that have been obtained, I may state that during the first ten months run (May 1902 to March 30th, 1903) the Payne Concentrator handled 33,000 tons of old and 7,000 tons of new stope fillings, from which 1,247 tons of high grade silver-lead concentrates were derived and sold to local smelters. In addition hereto 1,391 tons of 42%-43% zinc-blende concentrates, containing 8 ounces in silver, were produced as a by-product at no extra cost. A 1,000 ton lot was disposed of to the Lanyon Zinc Company of Iola, Kansas, and netted the Payne Company, after paying an $11 freight rate, $8 per ton. Encouraged by these results the company at once added a magnetic separating plant, whereby they have been able to, at a cost of from $1.50 to $2.00 per ton, improve the zinc product from 42% to 55%. This plant has now been in successful operation for the past four months and will no doubt be followed by other companies ere long.

For a moment we will leave the "high-grade" mines of Sandon, located at elevations from 4 to 8,000 feet, and see how the Silver-Lead-Zinc mines situated at altitudes ranging between 1,700 and 4,000 feet, fared in reference to the zinc question. Here we find that the ratio of silver in the galena is of much lower tenor, or approximately, one half ounce of silver to one per cent of lead, while in many instances, the lead contents is low and the percentage of zinc high. In the Kootenays an ore of this class is termed "low grade," and it will readily be understood that on these the penalty on zinc worked a severe hardship. In addition hereto the price of silver continued to decline, and when the American Smelting and Refining Company in January 1900, withdrew from the Canadian lead market and compelled the producer in Canada to sell his lead at much lower prices in the Continental market in competition with cheap Spanish and Mexican labor, it was not to be wondered at that the "low grade" mines were obliged to shut down. To some considerable extent this last feature has been overcome within the past eight months by the liberal bounty of $15 per ton granted by the Dominion Government for five years on all lead mined and smelted in Canada. The bonus has particularly proved of great benefit to the mines in a position to produce a heavy lead ore or lead concentrates, but in order to re-open the low grade lead-zinc mines it will first be necessary for the owners of same to make a by-product of the zinc, which may be disposed of at once if of sufficiently high grade to stand present freight charges, or stored until such time as zinc smelting works will be erected in British Columbia.

I have, in the above, aimed to show how the zinc industry gradually succeeded in struggling ahead. Kind reception could not be expected. For years the zinc had been looked upon as a mongrel intruding upon the peerless silver-lead ores. Was it possible that the black stuff, found everywhere in the mines and on the dumps, possessed any value, and if so, how was it that it had been wasted by the thousands of tons during a period of over ten years when prices of spelter in London and New York continued to soar higher and higher? Of all the difficulties that have been thrown up against the industry since its infancy, the very feature of even being tolerated was by far the most difficult problem to overcome, and it seemed that those who had done the least to stop the wasting of it were the least anxious to help it along, and the first ones to clamour about difficulties, many of which were either false alarms or have since been solved.

I am now getting to the juncture where I intend to point out certain complications, and I shall in my next chapter mention them in the order in which they appeared. By presenting them in the form of questions such as have often been put to me, I think they will be more conveniently answered.


MOTHER LODE QUARRIES.
SCALE
C.P. R'Y.
COTTAGES
DINING HALL
STORE
OFFICE
SHOPS
HOIST
BIN
CRUSHER (NOW IN USE)
STAIRWAY
BELT CONVEYOR
BINS CAP'Y 2000 TONS
ENGINES & CRUSHERS
IN ORE
OLD PROSPECT TUNNEL
ORE
Q'Y 1.
Q'Y 2.
Q'Y 3.
Q'Y 4.
Q'Y 5.
RAISE
MULE TUNNEL - (IN ORE FROM X TO Y) 580'
GREENSTONE
LIME
PORPHYRY
SOFT BLACK TALCOSE ROCK
CUT IN ORE
PROFILE ON LINE A-B
SHAFT 325' DEEP.
POCKET
MULE TUNNEL - 1% GRADE

Notes on Mining and Smelting in the Boundary District, B.C.*

By Frederick Keefer, M E., Greenwood, B.C.

Two years ago the writer contributed a paper on mining low grade ores as carried on at the Mother Lode mine in the Boundary District. It is the purpose of the present paper to briefly note developments of the system, particularly as regards the quarrying and economical handling of ores, and also to touch upon certain features connected with smelting operations.

At the mine in question, the series of quarries has been extended until there are at present four raises to the surface from the main tunnel, with a fifth in course of driving. In so far as possible, the tops of these raises are maintained funnel-shape so as to reduce handling to a minimum. While the pits remained shallow it was an easy matter to remove barren or very poor rock by loading it into cars and tramming to waste dumps ; but as the funnel system developed it became quite inadvisable to remove any except large bodies of waste, for the cost of removal had become greater than the cost of smelting. Experience has shown, however, that the evil effects of these smaller bodies of waste have been more than offset by the improvement in the general run of the ore body due to lesser quantities of partially leached surface rock being included. So that the average copper contents of the 135,500 tons mined in 1902 was appreciably less per ton than that of the 137,800 tons mined in 1903.

In places, however, large dykes of epidote and alkali porphyry, and occasionally isolated bodies of limestone occur, which are removed by blasting into raises, all the ore having been previously withdrawn.

The crusher plant located at the entrance of the quarry tunnel has taken care of quarry ore alone, that from the stopes being crushed by a Gates machine located at head of shaft.

Work is now being carried forward to consolidate the crushing plants and to do away with the Gates machine, which, although a No. 5 size, is entirely inadequate to the demands made upon it.

To this end a tunnel is being driven to intersect the main shaft on the same level as the quarry tunnel. At the shaft will be located a very large pocket, and this will discharge into five ton skips which will replace the cages now used. The skips will empty into a bin at the head of the shaft, thence passing to either one of a pair of Jenckes-Farrell crushers, each crusher having a jaw opening of 2x3 feet. These crushers will be driven by a pair of 100 h.p. engines so arranged that either engine can drive either crusher, this to eliminate all chances of stoppages through breakdowns in either engines or crushers—stoppages which past experience has shown to be inevitable as well as costly. The crushed ore will be conveyed by a Robins belt to the main ore bins. All car dumping and opening of bin and pocket gates will be done with compressed air. The same skips and crushers will, of course, serve all levels in the mine.

Although the ore will need to be handled further under new management, crushing costs will be lowered. For the reason that aside from stoppages for repairs to machinery being practically eliminated, the provisions of capacious pockets and shaft bins insure steady operation of crusher, which machine, if constantly supplied with ore can crush a furnace days run in a single shift, instead of this work taking one and a half shifts as at present.

Jamming of elevator buckets, constant repairs to them, and their clogging with frozen fines in winter will be eliminated—all serious drawbacks to rapid work. The short tunnel to shaft will also become the general entrance to mine, both for men (whose houses are all on this level) and for materials from shops and storehouses.

The main features of this work are shown in the accompanying plan.

In the matter of power, the cost of this item at the mine has been greatly reduced through the consolidation of power plant, and the driving of all machinery with compressed air. The 100 h.p. crusher engine formerly steam driven from boilers near by, now uses compressed air which is heated to a considerable degree just before entering engine. This expedient has effected a direct saving in labor and fuel of from 5 to 7 cents per ton of ore crushed. Air is furnished by a cross compound condensing Corliss compressor, capacity 3,200 feet free air per minute. A pair of boilers located near crushers and hoist can furnish steam on short notice should the compressor machinery break down, thus guarding against stoppages through this cause.

From a smelting standpoint, the ores of the larger Boundary properties have as a rule grown less basic as the workings have extended and deepened. That is to say, the proportion of iron oxide ores to the whole ore body has sensibly diminished, there being no great change in the amount of other base. Whether this reduced proportion of base to acid is to remain permanent, it is (at least in the case of the Mother Lode mine) quite impossible to predict. Long experience in mining these deposits has shown that it is impossible to make safe predictions as to occurrence of zones of mineralization, new ore bodies being frequently found in unexpected places. On the 200 ft. level of this mine there has been found considerably less oxide of iron ores than in either the quarries or the 300 ft. level. The iron oxides of this latter level are uniformly of higher grade than those of the quarries, carrying more copper and gold, and do not appear to be directly connected with the upper deposits, although this is not absolutely proven. No exploratory work has been done beneath the 300 ft. level, (which is about 500 feet under the highest croppings of the ore).

A considerable body of iron oxide ore is at the mouth of the main tunnel, but no work has been done on it owing to close proximity of the crusher plant.

This change in the basic character of the ore is illustrated by the following average slag analyses, taken over corresponding periods 1901-2 and 3. The small tonnage of foreign ores treated affect the assays somewhat, but not materially.

Year	Silica	Iron	Lime	Total
1901	33.2%	28.5%	20.6%	82.3%
1902	40.5	22.2	20.2	82.9
1903	42.7	20.4	20.2	83.3

With slags running in silica from 40 to 43 per cent. and with matte at 40 to 45 per cent. copper, it is found that the furnaces can be maintained in good running condition, and slag losses kept within proper limits.

Therefore, to guard against possible scarcity of iron fluxes, it has become general practice to conserve the iron ores of the mines, using only sufficient to keep slags within bounds above indicated.

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* Paper presented at the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

The Imperial Coal & Coke Co., of Montreal, has purchased the properties of the Alberta Coal & Coke Co., paying for the same 350,000 shares of stock, all the dues of the Alberta Co. to the Government, and all the miscellaneous debts of that Company. The Alberta Coal & Coke Company had leases on 6,400 acres of coal lands, four miles west of Cowley Station, Alberta, on the Crows Nest Pass branch of the C.P.R.

Notes on the History of Some of the Mining Districts of Lunenburg and Queen's Counties, Nova Scotia.

By E. Percy Brown, S.B., Bridgewater, N.S.

Glancing over the Annual Report of the Gold Mines of Nova Scotia we find that the districts of Malaga (Molega) and Whiteburne, Queens County, produced from the year 1862 to the present time 19,282 ounces and 9,625 ounces of gold from 20,846 and 6,583 tons of quartz respectively ; in both cases however the major part of this production extended only over a period of three or four years, from 1888 to 1892 or 1893. The history of these districts is, unfortunately, similar to that of many others in the Province of Nova Scotia and it may reasonably be asked if the meteoric rise and fall of many of our mines is the fault of the gold measures themselves or of the men operating them. This is an important question and one deserving of more than passing notice.

The first discovery of gold bearing rock in Malaga is said to have been made in 1886 and there was at once a tremendous rush for mining areas. Many rich finds were made and a regular western boom set in. The construction of a 20-stamp mill was started in 1887 near where some of the richest ore had been found and after the surface had been stripped from some dozen leads in the vicinity.

In the year 1888 the boom continued. The first 20-stamp mill was started and when sufficient ore was on hand yielded good returns. Three other crushers were built by various companies. One company, after doing a lot of indiscriminate work on a large number of leads, erected a very complete 20-stamp mill, going to so much expense on their air plant, drills, etc., that when the mill was ready to start the company was about discouraged.

The other two mills were erected largely as a consequence of excitement.

During the first few months of the year 1889 there were four crushers running at Malaga and the returns are given as 3,976 ounces of gold from 4,388 tons of quartz. In 1890 another mill was erected and the production for the year was 3,883 ounces of gold from 6,633 tons of quartz.

It would undoubtedly be very interesting if the amount of gold actually taken out of the ground during this year could be known. It is said that some of the men working in the mines at $1.00 or $1.25 per day not only supported large families, but, during the years of the boom, made small fortunes on which they have lived comfortably ever since.

In 1891 the returns were 4,664 ounces of gold from 4,826 tons of quartz.

In 1892 a production of 2,656 ounces from 2,720 tons of quartz is recorded, while thereafter a gradual falling off is noted with no accurate estimate of the yield.

The history of some of the individual operators would make an interesting record ; but space and policy forbid. One company is recorded as having operated, during 1890, thirty different leads with independent shafts on each. Another company, which operated about a dozen leads, confined its attention principally to four of these, on one of which it had seven shafts in a distance of 350 feet, and on another ten shafts in a distance of 450 feet. Hoisting was carried on from each of these shafts in small tubs, the ore being hauled to the mill by horse and cart. It can readily be understood what opportunities such a plan would give to a dishonest miner.

The system of mining pursued does not need further comment. The underground plan of one of these properties (which yielded 4.340 ounces of gold from 4,943 tons of quartz) is interesting (?).

The history of Whiteburne is too similar to the above to need detailed description. Is it probable that a few thousand tons of rich ore were thus scattered over one or two square miles of territory, and within one or two hundred feet of the surface, and that, since this ore has been removed, the deposit is exhausted?

It may be well to look at what has been done on some of the neighbouring districts.

The gold mining centres of Brookfield and Leipsigate are situated within a few miles of the districts of Malaga and Whiteburne.

The early history of Brookfield was somewhat similar to that of Malaga. In 1887, a year after its discovery, 1,691 tons of quartz from the property now owned by the Brookfield Mining Company, Limited, yielded 1,418 ounces of gold. A boom was the result. It was short lived, for the following year the mine was closed down. No doubt the gold measures of Nova Scotia were again blamed by the indignant stockholders.

In 1893 the mine was re-opened under its present energetic and business-like manager, and with an underground foreman who thoroughly understood his business. This foreman, though a Nova Scotian by birth, had had considerable experience outside this Province and saw that in other countries a mine was not closed down because the ore failed to yield an ounce to the ton, or because heavier machinery was needed to cope with the water as depth increased. A system of mapping and sampling the mine was started and thus a well defined pay-shoot of rich ore was located. Economic means of mining and handling the ore were introduced. The loss of gold from the mill was daily chronicled and a modern chemical plant was installed to take care of the values escaping amalgamation.

These are only a few of the steps taken which have made the mine of the Brookfield Mining Company one of the leading producers in Nova Scotia to-day.

Another mine at Brookfield, that of the Philadelphia Mining Company, was opened in 1888. In 1889 it yielded 1,796 ounces of gold from 1,472 tons of quartz. In 1890, 2,500 tons of quartz gave 1,643 ounces of gold and thereafter the returns are not reported.

About this time the mine was abandoned and, though it was subsequently sold and reopened, no serious attempt was made to work it.

At the present time the mine is being pumped out under the management of the foreman who was so successful, under the Brookfield Mining Company, in re-opening that mine and it will be interesting to note the results.

The chief feature of the district of Leipsigate is a strong fissure vein similar in many respects to that worked at Brookfield. It has been traced for considerably over a mile and several properties are located upon it.

One of the first opened was owned by a party of Germans from Minneapolis and Duluth who, about 15 or 18 years ago, erected two Wiswell mills and started out on a large scale. It is said that few, if any, of the company had seen a mine before and certainly some portions of the underground workings, exposed in subsequent operations, would seem to warrant this supposition.

After a year of this work the money of the operators gave out and the mine, in accordance with the fashion of that time, was abandoned, said to have "petered out."

About three years ago a company of Nova Scotians took hold of this property. They sank shafts through the old workings and,

after getting a safe distance below them, drove levels for several hundred feet in both directions along the vein, thus exposing a magnificent body of ore of several thousand tons which has yielded very satisfactory returns in the mill. This work was a further object lesson to the scoffers at the permanency of our gold deposits. Another property on the same lode was first opened by a local company who placed one of their number, a sea captain, in charge of operations. A mill was built under his direction and, though the quartz yielded an average of over half an ounce per ton, from a lead giving about two feet of crushing material and easily mined, the company were, after two or three years operations, forced to close down. There is no need to describe the system pursued in this case as all mining men are familiar with the method of underhand stoping employed under such conditions. Fortunately for the local company, and for the mine, some American capitalists came along at this time and purchased the property. They deepened and straightened the shafts, drove levels and installed a Cyanide plant. The treatment of the tailings dump from former operations yielded them sufficient profit to pay for a large portion of their improvements and at the present time they are pushing steadily ahead with good returns from the mill and Cyanide plant.

Other properties might be instanced but these will suffice to illustrate our point.

Does it now appear to the reader that, in the cases of Malaga and Whiteburne and similar districts, our gold measures should receive all the blame for non-productiveness?

The Geological Survey of Canada as an Educational Institution.

By Prof. T. L. Walker, Toronto University, Toronto, Ont.

During the second quarter of the last century the investigations of geologists first received general recognition from those interested in the mineral industry. Then, for the first time, did the governments of progressive people seriously consider the wisdom of engaging trained scientists to examine systematically the lands under their controls with a view to learning the extent of their mineral wealth and the best methods of exploitation.

The Geological Surveys of England, India and Canada were formed during this period. In this country the Survey was to be an economic institution, but this, at times, necessitated the study of theoretical questions. Experience has shown that the two branches—economic geology and pure geology—must be taken up together, if the best results are to be attained. Of late it has often been urged that the Survey devotes too much time to purely scientific geology to the detriment of its economic work. The members of this Institute are agreed that too little exploration of the latter kind is attempted, but that can only be remedied by a larger staff and more generous support on the part of Parliament. I regard the scientific work as absolutely necessary if we are to achieve the best economic results.

It was impossible at first for the director of the Geological Survey of Canada to secure in this country men trained in geology and in the other branches of science required of those who attempt such work. Sir William Logan collected a staff, mostly untrained men—lawyers, masons and farmers—and in a short time they were doing work which has since become classic, not only for us in Canada, but for all the world. This was the beginning of the educational work of the Survey.

Large editions of the reports of the geological explorations are distributed, either free or at a nominal price, to those interested in geology and mining. This, too, is an educational side of its work which has been well sustained for half a century.

There is only one other method to be pointed out—the distribution of specimens of mineral rocks and fossils from Canadian localities to schools, libraries, colleges and learned societies. As a result of this there are now scores of collections accessible to thousands of students and scholars in all parts of Canada. I do not know just when this method was introduced, but I am glad to say that this is still a very fruitful branch of the Survey's educational policy.

It may be maintained by some that the Survey has no educational duties to perform, or that the work mentioned is only of very minor importance. I hold that it has had such a policy from the beginning, because it was early recognized that with the intelligent co-operation of mining engineers, college graduates and enthusiastic amateurs, much more could be accomplished than would be possible to a small group of state paid geologists working alone. At present Canada has very few trained field geologists in proportion to the great areas of unexplored territory. Apart from the work done by the state geologists very little has been accomplished. In England, France and Germany there are scores of amateurs who are doing work of the highest class. If, in Canada, we could only encourage the growth of such a band of volunteers, the advance of geological exploration would be much more rapid.

The absence of well-trained field geologists is much spoken of by those interested in the development of the mining industry. Competent leaders for exploring parties are scarce. It has been said that some years ago, at the time of the opening of the Yukon, if the offer of a certain firm, to build a railway from the Coast to the gold regions in return for extensive concessions in mineral lands, had been accepted, a large fraction of the staff of the Survey would have resigned their posts and taken appointments with the company. We cannot tell what might have been—such things are uncertain—but we do know that a large number have resigned their appointments on the Survey and gone into private work. There is a demand for trained men but no supply. This is evidence of the absence of a sufficient number of competent field geologists. The Survey has almost ceased to regard the training of geologists as one of its functions.

The universities and schools of mining may be thought to be responsible for this scarcity. We can give students a thorough training in certain branches of the subject, but in order to give field experience, it would be necessary for us to send out real exploration parties for several months every summer, and so far as I know, no Canadian college has been able to do this. It would be expensive and apparently unnecessary when one reflects that the Survey sends out over thirty such parties every summer. Year after year the best students in geology apply to their instructors for letters of recommendation, and send formal application for permission to accompany a field party of the Survey. They do not understand why it is that they fail in these applications. For ten years no advanced student in mineralogy, geology or mining, from the University of Toronto, has been able to secure a place on any of these expeditions. I know of some cases in which men quite innocent of any of these subjects have been sent out as field assistants, able neither to assist in the geological work nor to profit by the summer spent in the field with a trained geologist. Now I shall not undertake to explain the cause of this. We are in many respects like our cousins to the south of us. In the

United States it was found very difficult to secure the appointment of the best men for such posts and it became necessary to make their Geological Survey a sort of commission almost independent of the ordinary methods of selection. Now the director has no difficulty in finding out the best men. Is our problem capable of being solved in the same way?

In conclusion, I wish to repeat, the Geological Survey of Canada is, and has been from the beginning, an educational institution. In its generous distribution of its reports and of geological specimens it is following the right path; but it has almost ceased to co-operate with the Canadian universities, their best students finding it next to impossible to get field training on the summer parties of the Survey. Some even apply to the United States Geological Survey for permission to join their field parties. Advanced students want field training, and would in some cases be willing to go as volunteers without pay. For Toronto students at least the door has been shut for ten years.

The Zinc Resources of British Columbia.*

By A. C. GARDE, President the Silver-Lead Mines Association.

For the past ten years zinc ore deposits have been known to exist in British Columbia, especially in the districts where silver-lead mining has been carried on, but only within the past year has attention been paid to its economic feature. In many cases where the zinc and lead were intimately associated zinc proved a hardship for the lead producer, inasmuch as when it reached a limit of 10 per cent the ores were penalized at a rate of 50 cents per unit. With increasing depth in the Slocan and Ainsworth mines it has been demonstrated that the lead sulphides are often superceded by zinc. It has also been proven that the lead is so intimately disseminated with the zinc that processes for independent recovery of the two metals are now receiving the greatest attention in all sections where zinc ores have been discovered. This, naturally, has led up to opening markets for the zinc as a by-product, and while some of the mines have been successful in disposing of their zinc product at a profit in Europe and the United States, there are a great many properties with a complex nature of ores, with lower values in silver, that are not in a position at the present time and with present methods of concentration, to make a product that will stand the high cost of transportation abroad. With smelting and reduction works in British Columbia this would be entirely different, but until the character as well as the extent of deposits have been thoroughly explored, it is hardly to be expected that capitalists will invest in local reduction plants. They must be given assurance of finding a profitable investment by the report of a high authority on zinc. In addition to the direct benefit to the zinc miner the lead mining industry would receive additional attention inasmuch as exploration work for zinc ore bodies would lead to discoveries of lead ore bodies as well. This can be explained by the fact that lead and zinc ores are so closely related that there is no distinct line between the two minerals. Development of zinc fields would, therefore, at the same time, lead to new discoveries of silver-lead ores.

The zinc question is not a matter of local interest alone, but of national importance.

We admit that the selection of the specialist to examine our zinc resources in British Columbia is one of the essential features, and we have therefore suggested Professor Walter Renton Ingalls, of Boston, whom everybody considers eminent in his profession. Our idea is that he should make a general study of the zinc resources of British Columbia as to the grade of ores for spelter production, etc., and to give his opinion as to the best methods of development of the industry in general. In short, we desire a report that includes the commercial features as well, and will be useful in furthering the zinc mining and metallurgical industry of British Columbia. It is possible that objections will be raised by our patriotic citizens to engaging a foreign specialist for the investigation of Canadian resources, and indeed it would be most fortunate if any of our engineers in Canada could fill the want, but the zinc question is a specialty where an intimate knowledge and study is required, and we do not believe that such a specialist can be found in Canada, and it will therefore be to the benefit of Canada to employ the very best authority obtainable in preference to anyone who would be only fairly well familiar with the subject, but not a specialist on the same.

Specialists on this subject are confined to Europe and the United States, but no European can be readily reached or is likely to be able to grasp the economic conditions of the West at short acquaintance. It may be claimed that the cost of investigation should be borne by individuals or corporations, and it is probable that expenditures in this direction will be made by those able to afford this advantage, but the number of mine or claim owners in this enviable financial condition is insignificant compared to the number of those (especially of the prospector class) who hold properties carrying zinc values and who are not only uninformed as to the value of the zinc deposits they control but are financially unable to secure expert advice. This condition has for some years past been recognized by the United States government, who have had a corps of experts in the various zinc fields of that country with the most beneficial results as regards enlightening the general public as to the nature and capabilities of the resources which nature has placed at their command.

That the resources of the country as to zinc bearing ores are extensive, I have no hesitancy in stating. That the ores as to their physical features in the different districts vary considerably is also beyond question. One feature that has puzzled the miner and metallurgist considerably is the silver bearing nature of the zinc ores. There are mines capable of producing a very large tonnage of first-class zinc ore, which would only carry up to six ounces in silver, while on the other hand we have mines that have large bodies of zinc ores carrying high silver values. Zinc ores containing extremely high silver values are not unusual in this province. I am familiar with certain small bodies of zinc ores in the Slocan and Ainsworth camps that will carry from 1,200 to 1,500 ounces of silver per ton. Such ores are indeed exceptional in any part of the world, and processes for a close recovery of both the silver and the zinc values have, therefore, not kept pace with the rest of the metallurgical achievements obtained on the more commonplace types of ores. Consequently, the miner who produces a zinc ore with very high silver values is at a disadvantage and will, at the best, not be able to get smelter returns for more than two-thirds or three-fourths of the silver values. Undoubtedly this feature deserves particular attention and expert advice. In my estimation, however, the average silver contained in the zinc ores found in the Slocan within a circumference of ten miles (taking Sandon as a center) would be approximately 25 ounces per ton of 50 per cent. ore. I beg to emphasize this feature for the reason that it is generally understood by mining men in the Slocan, as well as by the public, that the British Columbia zinc ores

* Extracted from the Lead and Zinc News.

on an average would run far above this in silver. It has been pointed out by many that if the smelters could only afford to pay for three-fourths of the silver values the losses would be very high and that it would be better to leave these ores in the ground until some day when a higher recovery could be obtained.

What I wish to bring out in connection herewith is that the zinc ores of British Columbia even without silver values are worth mining for their zinc values alone, and if they contain some silver values besides, so much the better. The zinc industry should not be hampered nor prejudiced by the fact that a few properties might have an exceptional argentiferous zinc ore that it would prove difficult to get the full value for. Such ores cease to be zinc ores and should be classed as silver ores. It is my opinion that there is an unlimited amount of desirable zinc ores in British Columbia, fit both for spelter and zinc oxide productions. The highly argentiferous zinc ores as a whole should be regarded as exceptions from the rule and not allowed to interfere with the large ore deposits of strictly zinc bearing ore worth consideration for their zinc values only. Our main object is, therefore, as it will be understood from the foregoing, to give the Canadian investing public an opportunity to find out all the particulars of the zinc ore deposits in British Columbia. In the United States and Europe the zinc smelters have not been slow in realizing the future we have before us. Our zinc ores are now being exported every day to the markets of the world where they are made into spelter and zinc oxides, and later on returned and sold in the Canadian market. Unfortunately we have no zinc smelters in Canada, and the consumers will therefore have to bear the additional cost of transportation, duties, etc., not to speak of the profits that would add to the wealth of Canada if a new zinc industry was established here. As to transportation, we are at present shipping our zinc ores to Iola, Kansas, at a freight rate of $10 per ton, and to Europe at a freight rate of $13 per ton. It requires approximately two tons of our ore (or any other ore) to make one ton of spelter. On these two tons the freight amounts to one cent per pound, and in addition thereto we have to pay freight on spelter returned from Iola to Canada, which is $20 per ton, or one cent per pound. From this it will be seen that more than two cents per pound is added to each pound of spelter used in Canada for home consumption. From June, 1901, to June, 1902, the following zinc products were imported into Canada for home consumption, according to official reports issued by the Dominion Government, under a duty of only 5 per cent. ad valorem :

	Quantity	Value
Zinc white (or oxide) and red lead	12,324,884	$489,231
Zinc, in blocks, pigs, sheets and plates	3,905,552	141,560
Spelter, in blocks and pigs	2,035,872	80,757
Approx	9,000 tons	$711,548

It is an injustice to Canada, who, we will assume, has the zinc ores, fuel, etc., to look for a market for home consumption in a country where high tariff exists (viz., the United States) besides paying high freight rates on long hauls going out as raw material and coming back as a finished product, with an additional tariff charge of 5 per cent. As to the extent of ore deposits, I have mentioned in the above that in the Slocan there are several important veins of desirable zinc ores. On some of these veins considerable work has been done, but entirely for the purpose of obtaining the high silver-lead ores associated with the zinc. Any development work must therefore be credited to the silver-lead industry. Whatever zinc ore was taken out with the lead ores has for a number of years been wasted in the concentrators or left on the dumps, and treated as equalling so much waste. Hundreds of thousands of tons of zinc have in this manner been wasted through the tailraces and into the creeks. Furthermore a large amount of zinc has been wasted in the lead smelting furnaces and run out with the slag. When hereto is added penalties that have been charged the miner for excess of zinc in the lead ore, it will readily be seen that zinc to the value of several million dollars has been lost. It is impossible to give accurate figures in reference hereto, but I may state that out of a dozen concentrators, each of about 100 tons capacity, the average tailings would assay 20 per cent. zinc, and in individual cases would exceed 30 per cent. Whatever silver was contained in the zinc would of course follow same through the tailraces. In the Slocan mines located at elevations of from 3,000 to 8,000 feet, the veins run parallel, usually with a slight inclination from the vertical. The approximate strike is northeast and southwest. All of the important veins are true fissure, showing considerable signs of faulting and fractures in the slate formation of the country. In no particular instance has mining been carried on beyond a 1,000 foot depth, and here the evidences of increase of zinc is apparent. An unbiased observer must come to the conclusion that the lead, or at least a portion of it, is gradually being replaced by zinc-blende. If for no other reason, this feature alone would be of sufficient importance to the silver-lead miner to solve the zinc question. Unfortunately, while he knows all about lead he is not any too well posted on zinc. In depth he is confronted with ores of more or less complex nature and concentration propositions, and unless he can make a profitable by-product of the zinc ores, he will find it difficult to make his lead ores pay even with high silver values. If it was not for the liberal bounty of $15 per ton granted by the Dominion Government he certainly could not see his way clear. At any rate he has found out that he cannot afford to pay penalties to the smelter on excess of zinc when this amounts to $8 and $10 per ton, as they in many instances have proved to do. If, on the other hand, he is able to separate the zinc from the iron and the lead by means of concentration and magnetic separation, and dispose of the lead and the zinc to advantage, independent of each other, there will be no cause for him to dread the future of deep mining, and instead of looking at the zinc as an intruder on the peerless silver-lead ores, he will in time learn to regard it as a more valuable by-product than lead. London and New York prices of spelter which govern the markets of the world to-day have for a number of years showed considerable strength. At this time of writing the London price of spelter is £22 per long ton, while the London price of lead, plus the lead bounty of 75 cents per hundredweight, is only £15, 7s 6d. It will, therefore, readily be seen that spelter is commanding a far higher price than lead, a feature that has been overlooked by a great many. Peculiar and extraordinary conditions in British Columbia have caused the miner to overlook the prospects and advantages of zinc, also the losses to which he has exposed himself so long. Even at the present time it is with a great deal of tardiness that he realizes the bright future of zinc and the addition of a new and distinct industry to the present silver-lead industry.

The Dominion Antimony Co. have been getting some very beautiful ore in their bottom levels ; this ore which is mostly stibnite with a little quartz through it shows gold freely, and it looks very pretty on the black background. Recent shipments have produced returns varying from 40 to 45 per cent of antimony and from $50 to $56 in gold. It is interesting to note that prior to Mr. McNeil's ownership of the property no gold was ever paid for by the smelters. If the ore shipped in the past contained an equal amount of gold to that shipped recently nearly $150,000 has been lost to the Province through ignorance on the part of the shippers. We should say that the recent shipments contained none of the ore showing free gold.

The Imperial Coal and Coke Co., Ltd.

We have before us the elegant prospectus of this important company, which has just been registered with an authorized capital of $4,500,000, to which is appended the report of Mr. Gust. Sundberg, Graduate Royal Technical School, Stockholm. Following our usual custom in the case of promotions in the mining world which appeal to the public for funds, we shall proceed to comment upon some features of this prospectus which require consideration. As an industrial enterprise this effort has features which may fairly be grouped under two classifications—favorable and unfavorable. We will try to do justice to the former first, and, after careful investigation, are prepared to concede the following :

(1) The area of the property (60,160 acres) is large enough for all purposes, the number of seams of coal actually located and the aggregate thickness (110 feet) are probably as stated.

(2) Whilst the coal has not been sufficiently tested to justify a positive conclusion as to its persistency in depth, the analysis of samples taken at the surface is satisfactory, and justifies the conclusion that, at a reasonable working depth, coal of a satisfactory marketable quality may be mined to a practically unlimited extent. Such coal would, without doubt, be suitable at least for steam and domestic purposes.

(3) The facility with which the seams can be opened, and the moderate cost of mining, are distinctly favorable features.

(4) Owing to the open character of the Elk Valley, and the easy natural grade—not exceeding one per cent—the cost of railway construction will be moderate, not exceeding $15,000 a mile.

The foregoing are distinctly advantageous features, as they include abundance of good coal, ease of access and cheapness of production. There is, therefore, the backbone of a bona fide enterprise which, under certain conditions, would yield satisfactory results to the investor. Do these conditions exist ? Let us see.

(1) No mention is made of the price to be paid for the coal lands, whether they are being acquired by purchase from the promoters, if so, at what figure and on what terms—or, whether the shareholders step into the shoes of the original locators and simply take up the Government licenses.

(2) The only report is from a gentleman who, however estimable and competent, is an entire stranger to Canada and unknown in mining circles here. It would have inspired more confidence if Mr. Sundberg's conclusions had been substantiated by an engineer of known repute and who knew more of the local, and especially the market, conditions.

(3) There is too much reference to, and reliance on, the Crow's Nest Pass Coal Company, and the reference to their coal lands as "*adjoining*" is calculated to mislead, since the nearest point at which that Company is operating is about sixty miles from the nearest point at which the Imperial Coal Company's mines could be opened up.

(4) The prospectus claims that these seams are the "extension" of the C.N.P.C. Company's seams. Geologically this may be correct, but there the matter ends, since the higher percentage of ash and lower percentage of fixed carbon differentiate them from the latter very distinctly. Even the Michel coals of the C.N. Company (20 miles north of Fernie) contain higher ash and yield a less satisfactory coke than to the south, and the farther north one travels the more this difference is accentuated.

(5) The absence of tests, at sufficient depth to yield satisfactory results, especially as to coking, is a serious omission, and leaves these coals in the same category as those of the Blairmore section as to *high ash*. In view of this fact Mr. Sundberg's seventh conclusion is very far fetched, viz :—"There are several hundred million tons of fine coking coal in these areas." Fine coking coal is coking coal which is at least equal to the Fernie coal, because it is not the laboratory expert, but the smelter manager who will have to pronounce the verdict. Fernie coal produces coke with 10% of ash. Hitherto no other coal has approached this standard. The smelters, especially in a low grade country, can not afford to buy any but the best smelting fuel and therefore, until the Imperial Company has demonstrated that it can produce coke of this grade Mr. Sundberg's seventh conclusion must be held to be pure assumption.

(6) It will cost $1,000,000 to construct a railway from Michel to the Company's property on Fording river.

(7) No coal company for years to come can succeed with a capitalization as large as that contemplated by this Company. The experience of the Crows Nest Pass Coal Company proves this. The Managing Director stated publicly (at a banquet in Fernie on June 2nd) that up to date his Company had expended $6,000,000. After six years operation of a practical monoply, the dividends paid have been about $750,000, but, they have received *in premiums on the sale of stock* something like $1,500,000. He would be a clever expert indeed who could prove how much of the dividend payments came from this source, and how much from actual profits on operations.

(8) When the prospectus proceeds, in conjunction with Mr. Sundberg's report, to deal with the subject of "Market," it is erroneous to the last degree, and, if Mr. Sundberg had made himself acquainted with the actual conditions, his statement could only be labelled disengenuous—it is charitable to assume that he did not investigate this branch of the subject. He says : "For several years the smelting industry of B.C. has been suffering from the lack of a sufficient supply of coal and coke." If he had said "several years ago" he would have been strictly correct, but at the present time, and for at least a year, there has been a glut of both coal and coke in this market ; so much so that the mines of the C.N.P.C. Company have recently been working little more than half time, and not more than 70% of their coke ovens have been in operation. This Company, the first in the field, stumbling over initial difficulties, was a long time in catching up with the demand —now it has overtaken it, and is scouring Montana and Washington for sufficient trade to keep its mines at work. Apart from other advantages, too numerous to mention, it has the Great Northern Railway at its mines, and Mr. J. J. Hill either owns or controls its stock. In spite of these circumstances, which are matters of common knowledge throughout the Kootenays, Mr. Sundberg talks of Mr. Hill wanting 10,000 tons of coal a day, and suggests for the Imperial Coal & Coke Company an unlimited market in the States. Mr. Hill can and will get all the coal he wants from the Company in which he is so largely interested and to whose mines he has built his railways.

The crux of the whole question is in the market, and that is already so glutted that it is a certainty that *all* the companies now operating cannot continue to do so. To increase the number at present is suicidal.

Some delays are being experienced by the new Montreal & Boston Consolidated Mining & Smelting Co., Limited, in obtaining the funds necessary to make some of the large payments which are due on the consolidation agreement. The funds required for the enlargement of the smelter will not be obtained until after all payments due on the properties amalgimated have been made.

Another Coal Venture.

The latest recruit to the army of coal miners in the Blairmore district is none other than Mr. Rufus Pope the well known M.P. for Cookshire. Mr. Pope is at the head of a company which has purchased several sections aggregating 2,000 acres about two miles south-east of Frank. A capital of $60,000 has been subscribed and the property is being rapidly developed under the management of Mr. C. P. Hill. It has eight seams of coal varying from 6 to 20 feet in thickness lying at an angle of 65°. Some of these are bituminous and it is believed the coal will yield marketable coke. A branch line two miles in length has to be constructed to connect the property with the Crow's Nest Railway. Mr. Hill expects to be shipping some 300 tons a day before the end of the present season, and hopes ultimately to secure the bulk of the C.P.R. trade in that district. The foreman of works is Mr. J. Wilson who had charge in 1901-2 of the operations of the Hastings Syndicate near Blairmore.

Developments at Granby Smelter.

If there is anything in the old adage that "Where there is smoke there is fire"—then, to say the least of it, recent developments at Granby smelter are significant. No one who knows Mr. S. H. C. Miner will hesitate to accept his assurance, given a few days ago to the Nelson *News*, that there is no truth in the suggestion that this concern is now controlled by Mr. J. J. Hill; at the same time, the reiterated statement of Mr. F. Carter-Cotton to this effect can not be ignored, in view of Mr. Miner's admission that the bulk of the stock is held by Americans and he was not posted as to recent transfers. Whether Mr. Cotton's statement be absolutely correct or not, those who are on the ground, and have watched the progress of events from the inception of this gigantic enterprise, are fully convinced that there is not only smoke but fire in the rumor. The sudden and unexpected resignation of the three men who have been most actively identified with the company ever since Mr. Miner became the ruling power is in itself significant. No concern could afford in the natural order of things to part at once with three such men as Messrs. Flummerfelt, Galer, and Yolen-Williams. It is well known that Mr. Miner has neither the time nor the opportunity to take any active part in the oversight of the Company's affairs. For this reason Mr. Flummerfelt has acted as President's assistant and his removal clearly indicates the passing of the control.

Mr. Hodges who has managed the smelter with such conspicuous ability is now at the head of the whole concern and no appointments have been made in place of the officials who left. The development clearly places *official* control in the hands of Mr. J. P. Graves and *actual* control in the hands of the capitalists whom he represents. Mr. Graves was the original promoter of Granby properties; so long as American capital dominated the concern he was the official head. With Canadian capital largely subscribed by Mr. Miner and his friends, the official control was more actively exercised by the gentlemen who have just retired. It is a matter of common knowledge that last fall a very large block of stock was sold in New York. A reference to the list of directors shows that the majority are American and there is no reason to doubt, in the light of recent developments, that the control is in their hands. This fact occasions no concern locally, its chief significance consisting in its relation to a series of incidents which clearly demonstrate the progress of Mr. J. J. Hill's scheme for securing a substantial share of the transportation business of Southern B.C. We have referred elsewhere to his activity in the Fernie District, and it is surely not insignificant that the recent extensive changes at Granby should synchronize with the commencement of Mr. Hill's railway extension from Grand Forks to Phoenix, and with the amalgamation of the Brooklyn, Stemwinder, Athelstan and Boston & Montreal groups involving the construction of a line from Curlew to Midway. Truly Mr. Hill is a sagacious and far seeing schemer. His plans seem to be little understood even by those most directly concerned, and it is only when another link is forged that the on-looker gets a glimpse of the chain which is being constructed to ultimately complete a network of communication throughout the Kootenays. That this policy will accrue to the advantage of the Granby Smelter we can not doubt, since its only result must be to establish effective competition in the transportation of the ore and very sensibly to reduce the freight charges.

PERSONALS.

The many friends of Mr. Alexander H. Smith, formerly of Toronto, will be pleased to know that he has been appointed Superintendent of Los Reyes Gold Mining & Milling Company, Oaxaca, Mexico.

Mr. Louis Terven, E. E. (University of Wisconsin) has recently been appointed Chief Electrician of the Nernst Lamp Company, Pittsburg, Pa. Mr. Terven was for some time Electrician of the United States Navy Yard, Port Royal, S. C.

Mr. A. M. Mattice, Chief Engineer of the Allis-Chalmers Co, has returned from his European tour of inspection, and has now settled down to the duties of his position in Milwaukee.

The new Management of the Allis-Chalmers Co. is drawing to itself some of the ablest men in their respective lines in the country. The latest acquisition is Mr. Walter H. Whiteside, who has. until the past few days, occupied one of the most important positions in the Westinghouse organization, having been the Manager of the Detail and Supply Department of the Westinghouse Electric & Manufacturing Company, of Pittsburg, and, at the same time, General Manager of the Sawyer-Man Electric Co. of New York.

Mr. Whiteside's new position will be that of General Manager of Sales for all departments of the Allis-Chalmers Co., including, of course, the Bullock Electric Manufacturing Co., which has become the Electrical Department of the Allis-Chalmers Co. His experience thoroughly qualifies him for this important duty, which he takes up with the good wishes of his very wide circle of business acquaintances.

Mr. Whiteside entered upon his new duties about the middle of July.

George R. Mickle, Mining Engineer and Lecturer on Mining at the Ontario School of Practical Science, has gone to Germany. He will also visit England before he returns. He will be back in time to take up work at the beginning of next session.

M. B. Baker, B.Sc., of Queen's University, Kingston, has gone to Nanaimo, B.C., to examine and report on some mining properties for eastern capitalists. Mr. Baker recently made a report on British Columbia coal properties so that he is familiar with the ground.

Bernard Granville, an expert Mining Engineer with Bruebecker of New York, after a visit to the Cordova, Deloro and other mines in the Hastings district, expressed himself much pleased with the prospect, and considers that only more capital, and operations on a larger scale are required to make the low grade ores to be found there pay.

CHEMICAL NOTES.

SULPHUR IN PIG IRON.—In a paper by John J. Porter of Dubois, Pa. on "Some Examples of Irregular Distribution of Sulphur in Pig Iron," the writer draws attention to the fact that sulphur is always higher in the top of the pig than in the bottom, owing to the sulphide of iron being lighter and rising to the top of the pig before the iron solidifies.

A table of results on fine pigs is given below:

	Pig A.	Pig B.	Pig C.	Pig D.	Pig E.
Hole No. 1 Top	0.115	0.058	0.066	0.165	0.116
" 2	0.125	0.058	0.061	—	—
" 3	—	0.052	0.061	—	—
" 4	—	—	0.084	—	—
" 5	—	—	0.059	—	—
" 6 Bottom	0.040	0.030	0.029	0.175	0.103

All the sulphur determinations were made in duplicate by the evolution

method, without previous annealing of the drillings and in several cases were checked by gravimetric determinations. The writer notes as a point of interest that this iron from a furnace running on Virginia ores invariably evolved all its sulphur as hydrogen sulphide without previous annealing as shown by the close agreement with the gravimetric check analyses.

In the opinion of the present writer, it would have been interesting if Mr. Porter had also run check analysis by evolution after annealing drillings. As is well known it is extremely easy to get low results with certain gravimetric methods. It would also have been interesting if a full description of the evolution method used had been given as there are innumerable modifications of this method. As an illustration of the necessity of this the present writer would draw attention to the four results of sulphur determinations given below. The determiuations were made on Sample B Standardized Drillings of the American Foundrymen's Association. The drillings were dissolved in a fractional distillation flask fitted with separatory funnel and having a delivery tube leading into the absorption solution of 150 cc water and 30 cc Cadmium Chloride solution contained in a tall narrow tumbler. To the drillings in the flask, 50 cc strong hydrochloric acid and 50 cc water were added. When the stream of gas bubbles became intermittent a small flame was applied to the flask and the delivery tube was disconnected only after the flask was full of steam.

The results with different modifications are as below:

(a) The drillings were not annealed. Hot water (50 cc) was added, then 50 cc hydrochloric. Evolution was complete in 10 minutes. Number of cc Iodine used in titration—39.5.

(b) The drillings were annealed 15 minutes. Hot water was used. No. cc Iodine—39.3.

(c) Drillings annealed. Cold water used. Evolution complete in 15-20 minutes.

(d) Drillings not annealed. Cold water used. No. cc Iodine—31.0.

It is intended to follow this matter up. It will be noted that the first three results are practically the same, but the last is very low. It may transpire that, with certain irons, the use of hot water will accomplish the same end as 15 minutes annealing. This matter of determination of sulphur in pig iron by the evolution method is in an extremely unsettled state. The following extract from Field's paper on "Methods of Determining the Constituents of Cast Iron" is well worth reading in this connection.

"It has been shown that the rate of evolution of the gas causes a wide variation in the sulphur percentages. Mathewman (West of Scotland Iron & Steel Inst. Section of 1895-6) shows the following almost unbelievable results on a pig iron carrying 15% sulphur by the gravimetric method.

Time of evolution.	% Sulphur.
Very fast	.132
Rapid	.122
Ordinary rate	.092
Slow	.076
Very slow	.049

It will of course be understood that the use of hot water causes rapid evolution.

W. Dixon Craig,
Midland, Ont.

Determination of Antimony.—The following will be found to be an accurate and rapid method of determining antimony in sulphide ores.

Take sufficient ore to give from 2 to 3 decigrammes of antimony, add 10 cc of hydrochloric acid and keep at a temperature of 80° c until most of the sulphuretted hydrogen has been expelled, add 10 cc of water and 2 to 3 drops of strong nitric acid and boil briskly for a few minutes, filter and wash with hot 10% solution of hydrochloric acid. To the filtrate add three grammes of mossy tin and keep at a temperature of 80° for an hour, then bring to a boil until nearly the whole of the tin is dissolved, decant the supernatant liquid through a filter and wash the precipitated antimony, and any small amount of tin which may not have been dissolved, into a flask; add 20 cc of hydrochloric acid and 20 cc of water and boil gently, adding a few crystals of potassium chlorate from time to time; when the metal is completely dissolved boil off the excess of chlorine, and test with iodized starch paper to make sure that no chlorine is present in the solution, allow to cool add 3 grammes of potassium iodide and when the latter has been completely dissolved titrate with a solution of sodium thio-sulphate a convenient strength been 41.32 grammes per litre, 1 cc of which will equal about 10 milligrammes of antimony.

The rationale of the method is that tin precipitates no metal from its solution, other than antimony, having higher chlorides which are reduced to lower chlorides by potassium iodide.

This method has been used on ores containing stibnite, native antimony and kermisite, and has been found quicker and equally as accurate as the more usual methods.

In the event of ores containing difficultly soluble oxides, the usual methods of getting them into solution must be first adopted.

F. H. Mason,
Halifax, N S.

ELECTRICAL NOTES.

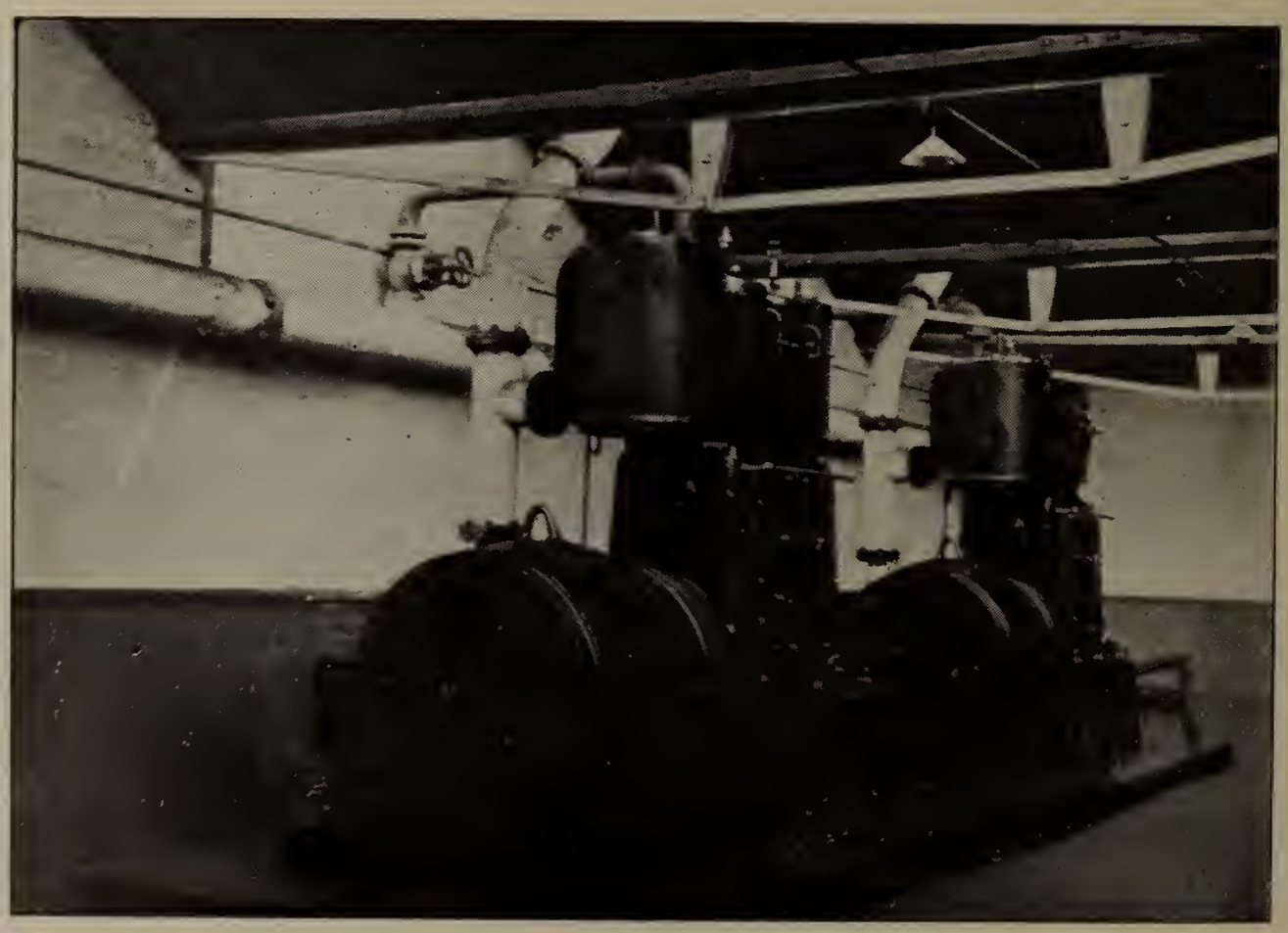
A thoroughly practical 3-phase electrical power plant is most desirable in mining work, and the following description of such a plant, put in at a Yorkshire colliery, is therefore likely to be of interest and use to our readers.

The colliery at which the plant was installed is a large one, putting out over 3,000 tons of coal per day, from shafts over 1800 feet deep. The plant was put in to supersede a steam haulage plant, and before the electric plant was ordered a correct test of the consumption of steam, by the existing plant, was made. The boilers supplying the steam haulage engines, were afterwards used to drive the engine supplying the current to the 3-phase system, and the saving effected amounted to 65 p.c. of the steam used for steam haulage. In addition, the running costs of the 3 phase system, including interest on the new capital invested in the plant, were less than the costs of the old system.

The plant consists of two Musgrave, high speed, compound engines coupled directly to two 3-phase generators of the General Electric Co. type. The engines have 12 in. and 18 in. cylinders with 10 in. stroke, and run at 420 revolutions per minute. The generators are 6 pole, with an intensity of current of 500 volts and a frequency of 40 cycles per second. The efficiency of the generator is named at 90 p.c. at full load, and 80 p.c. at half load; the consumption of steam is 16 lbs. per I.H.P. at full load. The armature has 36 coils, twelve for each of the three phases; the type is that of the revolving field.

The exciting dynamo, furnishing current to the field magnets, is carried on a bracket forming an extension of the bed plate of the machine; the shaft of the excitor is connected mechanically to the shaft of the generator. In the accompying cut, the excitor will be seen at the left of the cut.

There are two sets of conveying cables or wires, each consisting of 37 wires of No. 1, 16 gauge and each insulated by paper. These cables (3 in 1)



are enclosed in a lead covering or pipe. Each of the cables is capable of carrying current for the whole of the work.

The switch board is in the engine room on the surface, and is arranged so that either cable can be connected to either dynamo at will; as either dynamo is able to furnish current for the whole haulage this switch board is of much value.

The haulage plant is of the endless rope type. Three endless rope pulleys are arranged on one shaft, by means of friction clutches, so that either of them can be clutched, in or out, at will. All three can be run together, or any *single* one that is desired. The main driving shaft of the endless rope system is driven from two intermediate shafts, which can be used together, or either singly, by itself, at will. Each intermediate shaft is driven by a 3-phase motor, through spur gearing, the motors running at 470 revolutions per minute, and the main shaft at 11½ revolutions per minute. Each motor has its own starting apparatus, consisting of resistance which is inserted in the rotating circuit when the current is first switched on, and gradually switched out as the motor gets up speed. The motors are of the "wound" type, as it is termed, in which a drum built up of iron plates, having slots in its periphery, has coils wound in the slots, and also an arrangement for connecting the coils to the resistance when starting up. There is no connection between the rotor (the part which corresponds to the armature) and the stator, the stationary part, which corresponds to the field magnets in continuous current machines.

A notable feature of this plant are the provisions made by which stoppage of the haulage is rendered almost impossible—except at volition: generators, cables, motors, shafts etc., etc., all being in duplicate. Electric power is also used for pumping water to the boiler plant.

MINING NOTES.

NEWFOUNDLAND.

The talc property near Manuels is to be developed; thirty men have been set to work in the pits and a number of others are grading for a siding to the terminal of a wire rope tramway which is to be installed. The tramway will be between three and four miles in length, running over 43 towers which vary from 20 to 50 feet in height. The shipping harbor is Duffs, where a large pier is to be built.

NOVA SCOTIA.

The shipments of coal from the mines of the Cumberland Railway & Coal Company for June amounted to 39,365 tons.

Recent explorations with a diamond drill are reported to have discovered large seams of coal beneath the thirty mile stretch of land lying between the Joggins mine and Springhill.

The total amount of bounties paid to the Dominion Iron & Steel Co. under the Bounty Act has amounted to $1,721,556 in the period of 32 months, since manufacture began.

A company has been organized at Halifax, N.S., to prospect oil lands near Scotch Village and Brooklyn, N.S.; it is known as The Midland Oil & Gas Company, Ltd.

The Dolliver Mountain Co. are the first to take advantage of the Government's offer of assistance for deep shaft sinking to prove the occurrence of underlying folds of ore.

The Nova Scotia Steel & Coal Co. have largely increased their holdings by leasing the submarine areas, outside of those held by the Dominion Coal Co., to a distance of nearly 10 miles. The area leased extends from Point Aconie south-easterly towards Scaterie Island and covers about 100 square miles, overlying all the important coal seams of Cape Breton.

The development of coal areas near Port Morien in Cape Breton is predicted in consequence of options on the leases held by the Cape Breton Coal, Iron & Railway Co. having passed into the hands of an English syndicate. Mr. Horace Mayhew, an English coal operator, is the President of the new corporation; Mr. Thos. Lancaster will continue as resident general manager.

The *Industrial Advocate* says that an old time arrastra is to be used on some gold bearing veins at Clam Harbor, Nova Scotia. The arrastra has the points of cheapness of construction, and of operation, and, in the hands of Mexicans, has also the point of greater extraction than by stamping; but its adoption for Nova Scotia would be a retrogression and not an advance.

It is refreshing in this very dull period of gold mining to see such excellent returns from the Brookfield Mining Co. During the three months ending June 30th 2527 tons of ore produced 1088 oz. 5 dwts. of gold, while the first month's work of the cyanide plant produced 93 ounces.

A cargo of Mesabi Range iron ore, guaranteed 60% metallic iron and not over 1% phosphorous was shipped during the first of the month to the Dominion Iron & Steel Co. at Sydney C.B. The shipment was made by Pickands, Mather & Co., and the gross weight was 1,704 tons. This, we believe, is the first shipment of Lake Superior ore to the Sydney works.

The boring for oil at Cheverie, in Hants County, has proved useful in a way not anticipated by the promoters. At a depth of 1,400 feet in one hole and 1,800 feet in another brine springs have been struck which are said to contain 25% of solids in solution, 95% of which is chloride of sodium. The property has been bonded by B. F. Pearson and others and we understand that it is their intention to put up a plant capable of producing 700 barrels of salt per day.

The Grand Sub-Council of the Provincial Workmen's Association formally declared the Strike at the works of the Dominion Iron & Steel Co. to be "off" on Thursday, the 22nd inst. The strikers are to return to work at the rates in force at the time of striking, there is to be no discrimination against the strikers on the part of the company and harmony in the future is promised.

The depletion of the funds of the strikers and the unwillingness of the miners of the Dominion Coal Co. to strike in sympathy hastened the decision. Reliable estimates place the loss to the strikers in wages alone at not less than $290,000, besides which the reserve fund has been almost extinguished.

A company is being incorporated to be known as the Eastern Cement Co. with works at St. Peters, C.B. The Company have purchased a limestone quarry at Barron Point on the Bras d'Or Lake, nine miles from St. Peters, and have also clay and shale properties under option. Four bore holes have been put down and the analyses of the cores were very uniform. Two tons of the stone were shipped to England and made into cement, and the manufacturers reported that the stone was eminently suited for the manufacture of Portland Cement.

The stone is really an hydraulic limestone, the mortar in the St. Peter Canal and Bridge being made from the burnt stone.

The following is the analysis of the burnt stone:—

Lime	80.7
Silica	11.5
Alumina	3.6
Ferris Oxide	3.0
Magnesia	.5
Mangan Oxide	.1
Sulphuric Oxide	.5

ONTARIO.

Advices state that a 50 ton Elmore oil process plant is to be erected at Massey Station, by the Massey Station Mining Co.

Ore shipments from the Helen mine to Lake Erie ports started this month.

A recent letter advises that the troubles of the Big Master mine have been settled for the time being, and that active work will shortly be resumed.

Reports are current that a third attempt to work the Foley mine, in the Rainy River District, is to be made this summer by residents of Houghton, Mich.

It is reported that a strike of rich ore has been made at Belmore Bay, Sturgeon Lake district, on the property belonging to the Northern Light Mining and Development Co.—the tests claim from $50 to $60 per ton.

The Burley mining property is apparently to once more start its machinery in the endeavor to get pay ore from its submerged territory, if the presence of Mr. J. Burley Smith in the neighborhood of the Sultana mine is correctly read by the press of Rat Portage.

The Lake Superior Co. are not depending upon the Helen mine to supply iron ore to their Sault plant. What ore the mine may be able to ship is to be sold for American consumption.

The 50,000 tons, or more, of Bessemer pig, needed for the Company's rail mills will be purchased in the United States, and the company are hoping that the Ontario Government will renew the order for rails for the Temiscamingue Railway given last year but unfilled by the Company.

The corundum business is to have another company added to its list in the shape of a New Jersey corporation known as The Ashland Emery & Corundum Co., which has been licensed to carry on business in Ontario with a capital of $75,000.

The Northern Iron & Steel Co. is the name of the new corporation which has been organized out of the ruins of the former Cramp Steel Co. of Collingwood, Ont.; the capital of the new company is to be $1,250,000 preferred 6 p.c. stock with an equal amount of ordinary stock.

The New York & Ontario Gold Mining Co., Limited, gives notice of the passage of two by-laws, one to increase the number of its directors from five to eleven, the other to provide for holding of special meetings of the shareholders and directors in the City of New York.

The Atikokan Iron Co., Limited, has been authorized to increase the number of its directors from three to five.

Supplementary letters patent have been granted in Ontario to The Elgin Field Oil and Gas Developing Co. of Dutton, Limited, authorizing an increase of its capital stock from $49,000 to $200,000 by the issue of 151,000 shares of new stock at one dollar each.

The following mining leases granted in the Province of Ontario, have been cancelled under Section 36 of the Mines Act of 1897 and amendments thereto:—The south-west quarter of the north-west quarter of Section 17 in the Township of Salter, in the District of Algoma, containing 40 acres, granted to Allen Robert Baker, on the 4th of April, 1900; the south half of lot 11 in the 1st Concession of the Township of Balfour in the District of Algoma, containing 160 acres, granted to Chas. Henry Collings, of Chelmsford, on the 9th of October 1899.

Considerable quantities of Lake Superior iron ore are being taken to the furnaces at Hamilton. It is carried by vessel to Sarnia, thence by railway, the Grand Trunk having put on an ore train. Some 20 carloads are shipped daily.

One of the Ontario Government diamond drills has been sent to Black Bay, Lake Superior, where there are indications of extensive copper deposits. The property is owned by the Black Bay Mining Co., of which N. B. Carlson, of Willmar, Minn., is Secretary. A number of other copper

prospects in the same neighborhood are being looked into. The present low price of copper is the only thing in the way to prevent some of these properties from being worked, but it is expected that they will be developed before long, especially where the copper is found in combination with gold.

The Sarnia Refining Co., encouraged by the new regulations respecting crude oil is about to extend its operations. Ten acres more land have been purchased and $300,000 will be spent in improvements, which, when completed will give employment to from 150 to 200 more hands. The first cargo of American crude to arrive at Sarnia under the free tariff, consisted of 12,000 barrels for the Imperial Oil Co.

Mr. Parmelee, of the Department of Trade and Commerce, Ottawa, has been in the Western Ontario oil fields, consulting the oil men as to the best method to be adopted in paying the bounty provided for under the new regulations.

A. McIntyre has struck another good oil well on the 12th line of the Township of Eniskillen.

Thirty-five carloads of oil were shipped from Bothwell during June, or over a carload per day.

A gas well is to be sunk on the Arderlay property at Dunnville. A gusher has been struck at Byng, in the same neighbourhood.

A well put down by D. S. Robb's Co. at Leamington, to the depth of 2,000 feet, turned out to be dry. Numerous wells are being sunk and oil is in evidence as well as gas.

The stamp mill at Deloro, Ont., has a contract to crush 2,000 tons of ore for the Cook Co.'s mine south of that place.

Work has been commenced at the Bannockburn Gold Mine by the Continental Mines Co.

Considerable prospecting is going on at Pelee Island and the show is considered good for gas.

BRITISH COLUMBIA.

The old placer diggings near Ymir are attracting attention again this summer.

The old Cliff mine at Rossland has started work again after an idleness of four years under the charge of Mr. Robert Angus, lately of the LeRoi mine.

The present value of the ore coming from the Ymir mine is a little less than $3.00 per ton according to reports from the London office.

The western papers assert that Mr. Jas. J. Hill now has control of the Granby mines and works through uniting the holdings of a large shareholder to his own.

Up to the 1st of July the Granby Furnaces had treated 312,795 tons. The total ore products of the Boundary for the same half year totalled 413,007 tons.

The tonnage sent from the LeRoi mine in June, to the Northport smelter amounted to 6,055 tons of picked ore; that sent from the LeRoi No. 2 smelters was less, being 1,600 tons.

The Silver Cup Mine in the Lardeau, near Ferguson, West Kootenay, is turning out bars of bullion from its new combination mill. Ore of satisfactory grade is reported to be plentiful.

The War Eagle and Centre Star Mines have both been shipping milling ore to the Rossland Power Co's works during the month; some minor details only are delaying the starting of the concentrator.

The Alamo, Idaho, Payne, Slocan Star and Wakefield Mines all shipped zinc ores this month. The largest producer was the Slocan Star which averaged 20 tons a day, the Payne averaged about 15 tons daily; the daily average of the mines mentioned was 45 tons.

In an upraise from No. 1 Tunnel of the St. Eugene Mine, at a point about 1,600 feet in from the mouth, a new ore body has been found which carries higher values in silver than have yet been obtained from other portions of the mine. This new find is reported as being 14 ft. in width.

Before leaving this country for England, Mr. Anthony J. McMillan made the statement that the LeRoi Co. do not intend to close either the LeRoi Mine or the Northport smelter at present. He reported the mine as in very good condition, and a large amount of ore to be in sight.

Reports from the Lillooet District say that high water has somewhat interfered with dredging operations during the last few weeks; the big dredge of the Iowa Co. is working regularly but with smaller returns than at first; at Lytton both dredges are idle owing to the high water.

The Canadian Smelting Works at Trail, B.C., are busy erecting the plant for making lead pipe, and expect to be in the market with that product in August. It is also contemplated to put in a plant for the manufacture of sheet lead if the lead pipe plant shows satisfactory earnings. The refining works are now turning out eleven tons of pure lead daily.

The assets of the Mollie Gibson Mining Co. were sold on a judgment held by The Eastern Townships Bank at Sherbrooke, P.Q., on the 5th of the month. The property was bid in for a syndicate of the former shareholders, represented by Mr. S. W. Jenckes, for the judgment of $23,000. The syndicate will form a new corporation to be known as The Aspen Mining Co. and the property will be re-opened as soon as the new capital is subscribed.

The Canadian-American Coal Co., of Frank, Alberta, has re-opened the old tunnel, crushed by the landslide of a year ago, and is now extracting some 400 tons of coal per day from it. The bulk of this amount is taken by the C.P.R. for locomotive use. The shaft has also been cleaned up and re opened to a depth of 370 feet. By August it is expected that this shaft will be in a position to produce 400 tons daily. At the present time a force of 125 men are kept steadily at work.

The installation of electric power at the Mother Lode Smelter of the B. C. Copper Co. is reported as working very satisfactorily. The electricity is brought about 5 miles from the Phoenix, sub-station of the Cascade Water Power and Light Co., Ltd., and the ultimate power delivered amounts to a little less than 800 h.p. The Company makes a matte carrying about 50% of copper, which is blown in the converters to a 98% or 99% black copper, and then shipped to an Eastern refinery.

Strikes of rich silver ore, in the shape of horn silver and the black sulphurets of silver, are reported on the south fork of Kaslo Creek. The location is near the mouth of Long Creek and is supposed to be the extension of the line of mineralization running through the province and claims. The vein is reported to be about 18″ in width of quartzose matter lying between walls of talcose schist, and near the contact of the schist with the granite.

Advices from the Cariboo country are to the effect that there is plenty of water there this season, China Creek and other creeks in the vicinity of Bakerville have been running full for some time. The Consolidated Cariboo Hydraulic is expected to have a record yield if the water supply will hold through the season.

The forty stamp mill of the Nickel Plate property in the Similkameen, began dropping about the middle of the month and the reports from that section are to the effect that the mill worked *mechanically* to perfection but it is too soon to say anything about the percentage saved. The mill has a cyaniding plant as well as a concentration plant attached and should the work of the concentrators be found satisfactory the management will undertake the erection of a small blast furnace to utilize the concentrates in connection with ores coming from mines in the vicinity. There are quite a number of promising copper properties in the vicinity which would furnish the base for collecting the precious metal values in the concentrater.

Comparisons of the grade of the gold obtained from the Yukon with that coming from Cariboo and Omenica districts in B.C. are strongly in favor of the B.C. mines: the Cariboo gold coming from Keithly Creek and Quesnel Forks has a value of $18.20 per ounce; the Omenica in Cassiar gold averages about $17.75, whereas the average value of the gold from Dawson does not exceed $16.50.

The first clean-up of the Cariboo Consolidated Hydraulic Co. is reported to have been $60,000 but this does not represent work on new ground. If the water supply continues to be sufficient the September clean-up should be a very large one.

YUKON.

The June clean-up from the Amalgamated McKee Creek Mining Co's property amounted to about $10,000.

Advices received state that the coal found a Carmacks is of considerable thickness and can be delivered at Dawson at a lower price than is now paid for wood.

The new provision in the Yukon Regulations allowing the diversion of water from the original course of the stream, is being availed of by many claim owners; the time periods granted vary from five to twenty years.

The Detroit-Yukon Mining Co. have already commenced extensive operations on Bear Creek and have received a large portion of their equipment which was constructed in the United States last year for this corporation. It includes two steam shovels, four locomotives, twenty cars, each of the capacity of two cubic yards, and a miscellaneous equipment for the sluicing plant. The cars are to be filled by the steam shovels and then transported by the locomotives to the sluicing boxes where the cars will be dumped and returned to the gravel bank.

INDUSTRIAL NOTES

The street car system of St. Louis has found itself short of power to transport the large number of visitors attending the World's Fair, and in consequence application was made to the Fair authorities for permission to purchase power from some of the large exhibition engines. The authorities, in consequence, have assented to a contract between the St. Louis Transit Co. and the Allis-Chalmers-Bullock Co., by which the huge Allis-Chalmers engine in the Machinery Building will deliver power to the Transit Co. between the hours of 2 p.m. and 7 p.m. each day.

This secures an abundance of power to the Transit Co. during the busiest hours.

The engine, at 75 rev. per minute and 150 lbs. of steam, develops 8,000 H.P. It is used after 8 p.m. to supply the power to a Bullock generator which furnishes the current for the decorative lighting of the buildings and grounds of the Fair, supplying some 200,000 incandescent lamps.

The working model of a concentrating plant built by the Allis-Chalmers Company and exhibited in the Utah Section of the Mines and Metallurgy Building, is to be presented to the Utah School of Mines after the close of the St. Louis Fair. The Allis-Chalmers Co. is adding to its large exhibit at the fair an interesting display of the various sizes of crusher-shafts made by the Company. These shafts vary in size from a maximum of 17′ in length and 7 tons in weight to small ones of only a few thousand pounds weight.

The Allis-Chalmers report sales as follows:— To Mexico, two sets of battery mortars, to La Compania Aviadora de Mina operating La Natividad Mine; a new silver-lead smelting plant of 100 tons daily capacity to the American-Mexican Mining & Development Company; a 60 ton copper furnace to the Quintera Mining Company; a 40 ton dry crushing cyanide and lixiviation plant to Charles Brandeis. To Idaho, a 100 ton cyanide plant, to the Dewey Consolidated Mining & Smelting Company; a sectional ten stamp mill with accessories to the Twentieth Centuty Mining & Power Company, Ltd. To Michigan an Overstrom table to the Mass. Consolidated Mining Co.; a two stamp gravity battery to the Calumet Hecla Mining Company. To Arizona, an Erie steam engine and two 5 ft. Huntington Mills, to the Middlemarch Copper Company. To Pennsylvania, a Style "F" Gates crusher, to the Jones and Laughlin Steel Company; two new blowing engines of the vertical long cross-head type with cylinders of 44 and 84 inches diameter, and 60 inches stroke to the Redding Iron Company.

The Crocker-Wheeler Company of Ampere, N.J. announce that they have made an agreement with the electrical firm of Brown, Boveri & Co. of Baden, Switzerland, whereby they have secured rights to manufacture the alternating current machines of this celebrated Swiss firm. This New Jersey firm has already contracted for a 200 K.W. 60 cycle 440 volt alternating current generator for the Atlanta plant of the Proctor & Gamble Soap Company of Cincinnati.

The De Beers Company, Ltd. of Kimberley, S.A., have ordered a third Westinghouse-Parson steam turbine for their power plant at Kimberley, to be used in generating current of 1500 K.W. capacity. The new turbine is identical with the two which have been in operation at Kimberley for over a year. The new turbine will operate at 150 lbs. boiler pressure and about 25 inches of vacuum; on account of the altitude of Kimberley this will be equivalent to 27 inches of vacuum at sea level.

Messrs Hadfield's Steel Foundry Co., of Sheffield, England, have received an order for ten of their gyratory crushers, size T, from the Premier (Transvaal) Diamond Mining Company. These crushers have a capacity of 750 to 1,000 tons per hour and are intended for one plant.

add Ont mining notes

Digest of Recent Patents; Mining and Metallurgical.

UNITED STATES.

762,753—Apparatus for Magnetic Separation. Clarence Q. Payne, Stamford, Conn. A transversely-laminated separating-carrier provided with a plurality of contacting magnetizable laminae whose outer edges are wholly out of contact with those of their adjacent laminae, in combination with two-opposing magnetic surfaces both placed external to said carrier and between which said carrier is arranged to travel, and meaus for feeding the material to be separated.

762,580—Crushing and Grinding Mill. James M. Dyer, Douglas City Cal. The combination in an an ore-crushing and grinding apparatus, of a cone carried by a vertically-turnable shaft and having a spherically-curved base-flange a cylinder supported thereon and having a base concaved to fit the cone-flange, a tubular extension of the upper part of the cylinder with a surrounding grooved raceway; balls fitting said raceway; a ring surrounding the cylinder extension, said ring having a raceway in its lower surface retsing upon the balls and an upper convex surface; a concave plate fitting and movable upon the convex surface of the ring; and means for moving the plate in a horizontal plane to tilt the cylinder with relation to the cone.

762,774—Apparatus for the concentration of Minerals by means of Oil. James W. Van Meter and Martin P. Ross, San Francisco, Cal. An apparatus comprising a channel through which the oil flows, means for supplying pulp and water to the oil at the head of said channel, means in said channel at intervals for drawing off the settled gangue and water, means at the foot of said channel for separating the relatively upper and lower portions of the oil, and means for returning said separated upper portions of oil to the head of the channel.

762,867—Ore-Separator. Henry A. Allen, Chicago, Ill. An apparatus in which is combined a stationary circular closed receptacle, an inlet-pipe arranged tangentially thereto, discharge-openings above and below the level of the inlet opening, and a series of spirally-inclined ledges arranged with the forward end of one ledge above the rear end of the next succeeding ledge, the lower end of one ledge being below the level of the inlet-opening, whereby the material fed to the receptacle may be directed upwardly upon the inclined ledges while the heavier particles may be free to fall between said ledges.

763,019—Ore Sizer and Concentrator. Ansel H. Phinney, Turner, Mich. An ore sizer and concentrator comprising a vat having a discharge element at one end; means at the opposite end to supply material, suspended in liquid, to the vat, a plurality of hoppers below the level of the discharge element and forming a series of water-chambers, and a screen forming a false bottom extending over the hoppers and having longitudinally-disposed laterally spaced screen elements extending below the water-level of the vat, said screen elements serving to form a series of straight guiding-channels opening at the bottom into the hoppers and extending from the feed to the discharge ends of the device.

763,197—Ore Slimer. Ira F. Monell, Boulder, Colo. An ore-slimer comprising a main frame, a belt-frame supported in the main frame, rollers at the ends of said belt-frame, the said rollers being tapered from their centers outward, small rollers arranged between the first-named rollers, and tapered from their centres outward, an endless belt movable over the several rollers, and means for distributing stock onto the belt.

762,869—Apparatus for Treating Ores. Henry A. Allen, Chicago, Ill. An apparatus comprising a continuous closed separating system in which is combined a main circular separating vessel, means for introducing thereto the materials to be separated, a pipe system leading from the top thereof and back to said vessel with which it is connected by means of a series of induction-pipes arranged tangentially thereto, reservoir interposed in said pipe system each having an inlet at or near the bottom and an outlet at or near the top a pump for inducing a circulation, heating means interposed in said pipe system, and a normally closed outlet at the bottom of said separating vessel, whereby a vortical whirl may be imparted to the material and fluids in said separating vessel while the heated fluid may be used over and over.

763,260—Separation of the Metallic Constituents of Ores from Gangue. Arthur E. Cattermole, Highgate, London, Eng. A process which consists in agitating a mixture of powdered ore and water with oil in emulsion in water containing an alkaline emulsifying agent, so as to agglomerate the oil-coated particles into granules, and subjecting the mixture to classification to remove the small non-coated particles from the granules.

763,783—Concentrating Table. Gustav A. Overstrom, Anaconda, Mont. A Concentrating Table, in combination with means for imparting a reciprocatory movement thereto, said table having an unobstructed tailings-delivery edge, said edge being inclined away from the line of reciprocatory movement from the head end of the table toward the opposite end thereof, and riffles arranged in diagonal relation with respect to said table.

763,662—Apparatus for use in certain processes of Extracting Sulfide from Ores. Guillaume D. Delprat, Broken Hill, New South Wales, Australia, assignor to Broken Hill Proprietary Company, Limited, Melbourne, Victoria, Australia, a Company registered under the laws of Victoria, Australia. An apparatus in which the concentrates are floated to the top of a body of liquid, a pan having an inclined imperforate bottom down which the ore slides, means to feed liquid to the pan, a sump at the lower edge of the bottom for tailings, a discharge for concentrates at the liquid level of the pan, a baffle plate between the sump and pan extending from the discharge to near the lower edge of the inclined bottom to maintain a quiescent body of liquid in the sump and at the same time maintain a flow of liquid from the pan through the discharge.

July 5th.

764,044—Process of Smelting and Reducing Metals. Christian Diesler, Coblentz, Germany. A process consisting in mixing the materials to be treated with carbonate of lime and carbon, placing the mixture in an air-tight retort, exhausting the air from the retort, subjecting the mass to the action of an electric current within the retort and to the action of the gas generated therein in excess of five atmospheres of such gas, and exhausting such resultant gas after it has acted on the materials treated.

764,197—Concentraror. Charles H. Muhleman, Los Angeles, Cal. In a concentrator a concentrator pan mounted upon a shaft; riffles in the bottom of said pan arranged in radial rows; and means to give said pan a rotary gyratory motion comprising a bearing for said shaft intermediate its ends, in which said bearing said shafts is revoluble; a revoluble wheel having a socket into which the lower end of said shaft projects; said socket being at one side of the centre of said wheel.

764,332—Converter. Ralph Baggaley, Pittsburg, Pa. A converter having ventilated passages open to the air at the bottom, and other passages leading therefrom along the shell, said convertor having a burner for supplying auxiliary heat within the same.

764,355—Dump Car. Harry S. Hart and Otto W. Meissner, Chicago, Ill., assignors to Rodger Ballast Car Company, Chicago, Ill., a Corporation of Illinois. The combination of a supporting framework provided with upwardly extending side boards formed of swinging sections pivotted at their upper edges, and locking angle-bars pivotally secured to the framework of the car near the sides thereof to engage with the lower free edges of the swinging doors to seal and hold the same in locked position.

July 12th.

764,979—Ore-Concentrator. Samson Beer, Butte, Mont. An ore-mill, a pan, a driving-shaft extending vertically through the pan, a hub surrounding the shaft, a cap on the hub, a screw operating in said cap and engaging the top of the shaft for moving the hub vertically, a cylindrical part attached to the hub and having side openings, cheek-pieces extended outward from the sides of the openings, bearing-boxes mounted to rock in said cheek-pieces, and rollers having their shaft-bearings in said bearing-boxes.

765,042—Ore-Concentrator. Fred. N. Rogers, Denver, Colo. The combination with plurality of independent classifying concentrating-surfaces arranged for progressive concentration, of means for independently shaking the respective concentrating-surfaces to impart classifying movement to the pulp particles and a conveyor adapted to convey and deliver desired portions of the more or less classified pulp in a sheet from one concentrating-surface, without substantially intermingling or disturbing the existing classification thereof, to a succeeding concentrating-surface, thereby effecting a progressive concentration over the successive concentrating-surfaces.

765,013—Magnetic Ore-Separator. Frederick J. King, Croydon, England. A magnetic separator comprising a set of magnet-bars for sorting the material, and another set of curved magnet bars at right angles to the first set and overlapping the lower end of said first set for the purpose of separating the sorted material.

764,973—Device for Separating Slimes in Ore Reduction. Oliver P. Ankeny, Deadwood, S.D. A filtering-cell comprising a peripheral frame, a filtering-web covering the opposite sides of said frame and secured to the bars thereof; bars extending across said frame between the webs for spacing the latter apart, and clamping-bars outside the filtering-webs binding the latter to the edges of the spacing-bars.

July 19, 1904.

765,299—Crucible-Furnace. Charles W. Spears, Battersea, London England, assignor to the Morgan Crucible Company, Limited, Battersea, London, England. The combination with the moveable furnace-body, comprising a metallic casing having air-passages therein, discharge-apertures on the inner side of said casing communicating with the interior of the furnace, and a passage at the upper end of said casing communicating with said air-passages, a hollow base for supporting said furnace, hollow standards connecting said base with said passage at the upper end of the furnace-body and pivotally connected with the furnace-body to form a pivotal support on which it can be tilted, means for supplying air to said base and valves controlling the passage of air through said hollow standards.

765,520—Process of making Sulphuric Acid. Auguste L. Stinville, Paris, France. The process for the manufacture of sulphuric acid in lead chambers which consists in causing to circulate in the dishes of the said chambers acid having a density of 3° to 5° Baume below the density of the acid produced on the vertical sides, and having a temperature of 5° to 20° centigrade lower than the temperature of the gases in the chambers.

FRENCH PATENTS.

337,967—Iron-Nickel Chromium Alloy. F. & M. Laur. A selection is made of chrome iron ore and of nickeliferous ores, such as "garnierite" (a magnesium-nickel silicate,) a mixture of which is heated with the minimum of carbon necessary for reduction in an electric or other furnace. The product may contain ordinarily from 10 to 30 parts each of iron, chromium, and nickel, 3 to 12 parts of Silicon, and 3 to 5 parts of carbon. Such alloys are stated to be especially applicable in the preparation and refining of steel.

GERMAN PATENTS.

150,069—Electro-osmotic process for dehydrating Peat. Farbwerke vorm. Meister Lucius & Bruning in Hochst. a. M. Alkaline substances, or salts, which cause during the electrolysis on the negative pole a secondary alkaline reaction, are added to the peat.

NEW COMPANIES.

ONTARIO.

Sovereign Oil Co., Ltd.—Incorporated 8th Juue, 1904. Authorized capital $50,000 in shares of $100.00 each. Head Office: Comber, Ont. Provisional Directors: John C. Winters, Mount Morris, N.Y.; Wm. McIntosh, Petrolea, Ont.; John A. McIntosh, Toronto, Ont.

Empire Salt Co., Limited.—Incorporated 22nd June, 1904. Authorized capital $50,000 in shares of $100.00 each. Head Office: Sarnia, Ont.

Canadian Michigan Gold Mines, Limited.—Incorporated 15th June, 1904. Authorized capital $1000,000 in shares of $5.00 each. Head Office: Sault Ste. Marie, Ont. Provisional Directors: Wm. Coyne, Chas. J. Brown, J. A. McPhail, of Sault Ste. Marie, Ont.; John B. Spellman, E. S. B. Sutton, Otto Supe, of Sault Ste. Marie, Michigan; Harry Asmus, of Buffalo, N. Y.

Eldorado Mining Company.—Incorporated under the Laws of Arizona and licensed to operate in the Province of Ontario, 30th June, 1904. Authorized capital $50,000. Head Office: G.H. Draper, Rat Portage, Ont., attoruey for the company.

BRITISH COLUMBIA.

Hawkeye Gold Dredging Co.—Incorporated 19th May, 1904. Authorized capital $500,000 in shares of 10 cents each.

Palmita Mining and Development Co., Ltd.—Incorporated 6th June, 1904. Authorized capital $15,000 in shares of one cent each.

Kootenay Coal Co.—Incorporated 6th June, 1904. Authorized capital $1,000,000 in shares of twenty-five cents each.

Mt. Meadow Gold Mines, Ltd.—Incorporated 20th June, 1904. Authorized capital $90,000 in shares of three cents each.

White Channel Gold Hill Hydraulics, Ltd.—Incorporated 22nd June, 1904. Authorized capital $575,000 in shares of $1.00 each.

Royal Banner Copper and Gold Mining Co., Ltd.—Incorporated as an extra-provincial company, 10th June, 1904. Authorized capital $1,000,000 in shares of $1.00 each. Head Office in British Columbia: G. W. Averill, Attorney, Grand Forks, B.C.

Flathead Valley Oil Lands Development Co., Ltd.—Incorporated 7th July, 1904. Authorized capital $250,000 in shares of twenty-five cents each.

Elk River Coal and Oil Co., Ltd.—Incorporated 12th July 1904. Authorized capital $25,000 in shares of $1.00 each.

New Caledonia Nickel Output.

T. W. Gibson, director of the Bureau of Mines for Ontario, recently received a copy of a report, which gives some interesting facts respecting the nickel output of New Caledonia, hitherto the principal source of supply for the world's nickel, outside that obtained in Canada. The figures show that the production in New Caledonia is on the decline. In 1902 the island produced 129,653 tons of nickel ore which had fallen off in 1903 to 77,360 tons, which is only about half the output of the Copper Cliff Mines. The falling off is attributed to the competition from Canadian nickel. The New Caledonia report speaks in disparaging terms of Canadian nickel, for which there is no ground, for while the process of reduction is quite different, the quality when the metal is obtained is the same,

The report also gives the statistics of other ores which come into competition with Canadian products. The colony produced in 1903, of cobalt ore 8,292 tons, chrome ore 21,437 tons, and copper ore 9,845 kilo-grammes, in all cases an increase over the previous year, nevertheless the total mineral exportations fell from 12,283,285 francs to 8,963,895 francs.

International Nickel Co.

The International Nickel Co. which virtually controls the nickel output of the world, being interested in the mines both in New Caledonia and Canada, the two chief sources of supply, recently issued a brief report covering the year ending 31st March, 1904. The report is of an optimistic character. The president remarks:—"While the most of the improvements outlined in our report of last year have been completed, the reconstructed works at the Canadian Copper Company's plant are not yet wholly in operation; yet we are far enough along to convince us that our saving in the item of fuel for power alone will be very large, and we fully believe that other economies anticipated will be realized." Again "Our present foreign and domestic contracts are such as to insnre us a tonnage not less than we have enjoyed this year, for several years to come. This practical insurance of a tonnage sufficient to run economically far into the future, coupled with the fact that our efforts in exploiting the uses of our material are meeting with constant success, indicates staple and gradually increasing business." Some of the contracts referred to run for six years, thus giving a sure market for their product for a considerable time.

The financial statement shows earnings of $966,225, and expenses $624,123, leaving a net profit of $341,102.

The Canadian Copper Co. is a subsidiary of the International Nickel Co., and their product, from the only smelter working in the Sudbury district, is included in the above.

Nova Scotia Coal Shipments.

Company.	June, 1904	June, 1903.	Six Months. 1904.	1903.
Dominion Coal Co	347,357	261 843	1,218,515	1,379,075
Nova Scotia S. & C. Co	65,603	43.825	202,922	176,627
Cumberland Ry. & C. Co	39 365	38 321	204,542	230.438
Acadia Coal Co	23,624	33,041	123,097	168,974
Intercolonial Coal Co	23,481	20,090	122,368	114,428
Maritime Coal Co	3,660	.... ..	24,680	.....

Exports from Canada Nickel Fine in Ore, Matte or Speiss.

Year.	Quantity lbs.	Value.
1899	14,428,063	$994,437
1900	13,493,239	1,040,498
1901	9,537,558	958,365
1902	3,883,264	834,513
1903	9,032,554	878,159

The following are the net outputs of the various collieries of the Dominion Coal Company for the month of June:—

Dominion No. 1	37,810 tons.
Dominion No. 2	76,586 "
Dominion No. 3	41,356 "
Caledonia	50,066 "
Reserve	84,195 "
International	22,130 "
Hub	18,947 "
Total	331,090 tons.

CANADIAN MINING INSTITUTE

Incorporated by Act of Parliament 1898

AIMS AND OBJECTS.

(A) To promote the Arts and Sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications.

(B) The establishment of a central reference library and a headquarters for the purpose of this organisation.

(C) To take concerted action upon such matters as effect the mining and metallurgical industries of the Dominion of Canada.

(D) To encourage and promote these industries by all lawful and honourable means.

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MEMBERS shall be persons engaged in the direction and operation of mines and metallurgical works mining engineers, geologists, metallurgists, or chemists, and such other persons as the Council may see fit to elect.

STUDENT MEMBERS shall include persons who are qualifying themselves for the profession of mining or metallurgical engineering, students in pure and applied science in any technical school in the Dominion, and such other persons, up to the age of 25 years. who shall be engaged as apprentices or assistants in mining, metallurgical or geological work, or who may desire to participate in the benefits of the meetings, library and publications of the Institute. Student Members shall be eligible for election as Members after the age of 25 years.

SUBSCRIPTION.

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PUBLICATIONS.

Vol. I, 1898, 66 pp., out of print.
Vol. II, 1899, 285 pp., bound red cloth.
Vol. III, 1900, 270 pp., " "
Vol. IV, 1901, 333 pp., " "
Vol. V, 1902, 700 pp., " "
Vol. VI, 1903, 600 pp., now in press.

Membership in the Canadian Mining Institute is open to everyone interested in promoting the profession and industry of mining without qualification or restrictions.

Forms of application for membership and copies of the Journal of the Institute, etc., may be obtained upon application to

THE SECRETARY,
Canada Permanent Building, TORONTO, Ont.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the bonndaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquired promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones, five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Picton and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

CONTRACTORS TO H. M. GOVERNMENT

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Rutherglen, Glasgow, Scotland

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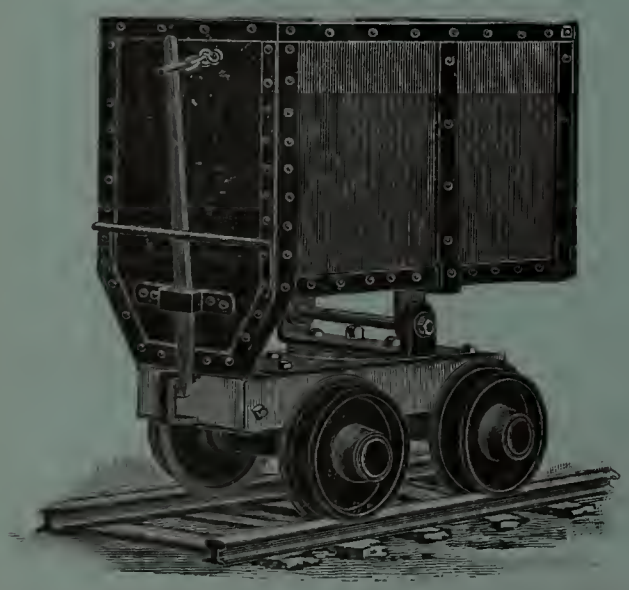

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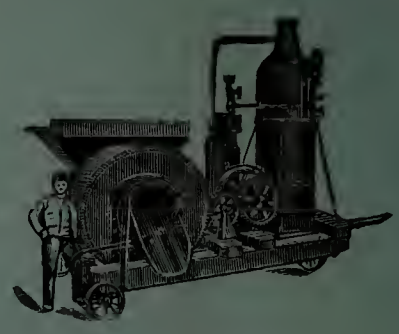

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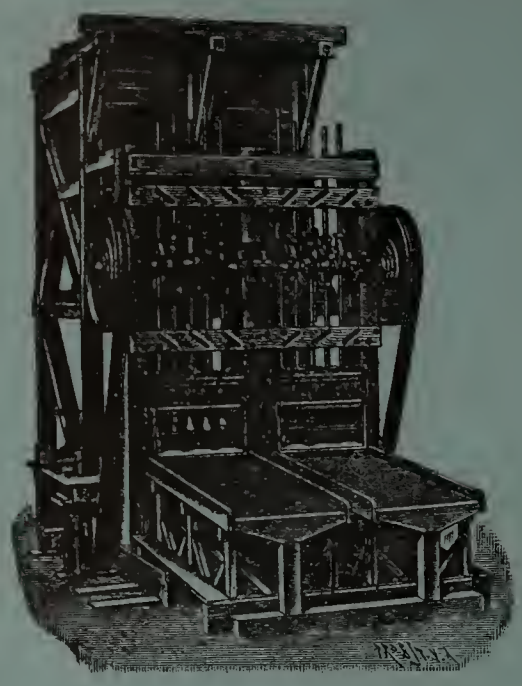

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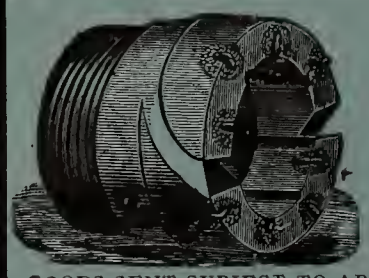

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CONTENTS.

A determined effort is noticeable in some of our B. C. exchanges to boom the oil lands of South-East Kootenay and Southern Alberta. As yet the only reports of authorities are the old ones of Dr. A. R. C. Selwyn (1891) and of Dr. G. M. Dawson. That oil is frequently found on the stagnant pools of water in this section is a matter of common knowledge, but that oil exists in commercial quantities, and can be obtained by drilling and pumping yet remains to be demonstrated. The Review is keeping a watchful eye upon developments, and has a correspondent in the field, whose views will shortly be laid before our readers.

We reprint in this issue, from the Lead and Zinc News, an article by the well-known engineer, Mr. J. W. Malcolmson, on the Custom Smelting Industry of Mexico, because of Mr. Malcolmson's expressed opinion that the supply of Mexican lead ores is permanently below the demand; and because of his remarks as to the unsatisfactory results which have followed attempts to separate the zinc from the lead in the ores which Mexico produces. Neither magnetic nor wet methods of separation would appear to have filled the need. In view of Mr. Malcolmson's paper, it would appear probable that the United States may again shortly be a possible field for the sale of B. C. lead ores.

That heroism is not confined to the soldier nor to the fireman, but is often met with in the more prosaic walks of life, has once again been demonstrated by the miners of the Union Mine in Virginia City, Nevada, the hoisting plant of which was burned in July. Shortly after the fire several miners entered a tunnel which at the time of the fire had been bulkheaded, and removed this bulk-head. Some of the miners venturing beyond the bulk-head to ascertain the damage done to the shaft and workings by the fire, were overcome by carbon di-oxide gas. Their fellow-workmen who remained near the mouth of the tunnel heard a faint call, and rushed into the inner workings, filled with the deadly gas, to rescue their comrades, one of whom was dead when they reached him. As the result of their daring and staunchness the rescuers are also very sick men; they knew what to expect before they entered the mine workings, but this knowledge did not prevent them rushing to the rescue of their comrades when help was necessary.

This fire furnishes another emphatic condemnation of the practice of putting head-frame, hoisting machinery, change-room, compressor, and practically all the surface equipment of the mine, under one roof; even though the buildings had been of corrugated iron, the danger of fires from other parts of the building being communicated to the head-frame, and thence to the timbers below in the mine, is too great for any manager or corporation to chance such a risk. Furthermore, the danger to men underground which may arise from the complete destruction of the head-frame and hoisting gear is too great to be entertained by any sensible manager.

The Review has at different times noted the development in the Similkameen Country which has been made by the Nickel Plate Mine during the last three years. Recent advices are to the effect that the results are likely to be fully up to what was predicted. The forty stamp mill was started this

month, and a clean-up made at expiration of the first 24 hours' run; the reported yield was about $10,000, but the tonnage crushed was not given. As a maximum it would not exceed 150 tons, and as a minimum it should not have been less than 100 tons; the yield per ton, therefore, was somewhere between $70 and $100. Doubtless this is far above what the mine will average, taking one month with another; at the same time the ore is arsenical, carrying much mispickel, and there will be a very considerable addition to the yield from the chlorination or cyanidation of the concentrates. The results must be very encouraging to the executors of the Daly estate, who have expended large sums for more than three years, but they will be still more encouraging to, and effective with, the owners of claims in the adjoining Similkameen country, who have been delaying work upon their own properties until results were obtained from the Nickel Plate. The Review extends its congratulations to Mr. Rogers for his persistent work and his now visible success.

A Practical School of Mines.

In a recent issue of that admirable weekly, the Mining and Scientific Press of San Francisco, mention is made of an innovation which the State School of Mines of New Mexico has made for the purpose of giving the students of that institution practical experience in actual mining. This innovation consists in the purchase of a mine in that State, where the students actually work under instruction, and free from the petty jealousies and unreasonable secrecies which are sometimes evident among the superintendents and foremen of the mines where students of the summer schools of the larger universities are permitted to have a few weeks' underground experience.

The article has suggested to the Review the possibility of some of our Canadian millionaires presenting to McGill, Toronto or Queen's Universities a partially opened and partially equipped mine, where practical instruction for considerable periods of time might be possible. As our esteemed contemporary fitly says—the young miner must be taught self-reliance, and required to take the initiative very frequently; where the mining school controls the mine and the commercial phase is subordinated to the educational results accruing to the students, opportunities are afforded which never obtain under the conditions existing about mines which are being run as business enterprises. Very clearly is this the case in regard to many items and small matters of teaching, which, though insignificant in one sense of the term, are exceedingly important factors in a complete mining education. For example—the timbering, track-laying, surveying, care of underground machinery and ropes, and a host of similar matters, which are rarely, if ever, brought to the notice of the student in a summer mining school.

The suggestion pre-supposes a condition which the Scientific Press makes no allusion to in its article, viz.: the possession of a teaching staff which is competent to act as instructors in the actual work to be done about a mine. Without in the least desiring to make any imputation against any of our mining schools, it is yet a matter of absolute knowledge that the majority of the instructors in the art of mining, and its allied subjects, are not selected because of their previous experience in actual mining, but because of their supposed proficiency in the art of imparting the knowledge they possess to other people. Nevertheless, we beg to suggest to the great benefactor of McGill University, Sir William MacDonald, the advisability of purchasing one of the abandoned copper-lead-zinc properties in the Eastern Townships of Quebec, and of presenting it to McGill University, with a fund which shall provide for its equipment in a modest way, trusting to good fortune that the work of the students may annually produce such an amount of merchantable ore as will partially contribute towards the payment of running expenses. The Review is quite willing to give its professional advice respecting the selection of such a property to any benefactor contemplating such a donation, and without fee. It has, indeed, often struck the editor of this paper that if the amount of money which has gone into the mining and metallurgical laboratories of McGill University had been expended in practical machinery, enclosed in a weather proof shed on an actually producing mineral property, the returns from the investment, in the shape of largely increased knowledge to the students, would have been much greater.

Like our contemporary, we admire the innovation which the New Mexican State School of Mines has made, and we think that its example can be followed with advantage by all similar institutions which are situated in the neighborhood of producing mineral regions. The kindergarten theory is applicable to the school of mines—it is much easier to teach something through the hand and eye than it is through the eye alone, and perhaps it is pertinent to recall to the officials of these higher institutions of learning that mining is, after all, but an art, though it may be founded upon truths of science and upon mathematics.

Adequate Supervision of the Mining Industry.

In an article apropos of the proposed Department of Mines or Bureau of Mining for the United States, our esteemed contemporary, the Mining World, in its issue of July 30th, points out that, although the United States is the greatest mining country in the world, it is the only nation which does not give, or provide, adequate supervision to the mining industry. Its remarks might be made applicable to a very large extent to the condition of things now prevailing in Canada. Of course, Canada can not compare for a moment with the United States in the variety and value of its mineral products, yet the tremendous advances which have been made during the last ten years in the value and volume of the mineral products of the Dominion make applicable many of the statements which the Mining World has seen fit to use respecting the condition of the industry in its relation to Government supervision in the United States.

The value of the mineral products of the United States for the year 1880 is given at $369,319,000 ; in 1899 the value as recorded was $976,800,000, and for 1900 it passed the billion

dollar mark, a threefold increase in 20 years. In Canada the value of the mineral products obtained for the first year on record (1886) was $10,221,000 ; in 1900 the value of the total mineral production of Canada amounted to $64,618,000, of which $40,500,000 was metallic, an increase of sixfold in fourteen years. Comparison of these figures shows clearly the relative subordination of Canada as a mineral producer, but a production of $64,000,000 justifies the establishment of some department, or separate bureau, which should have the care and fostering of this industry for its chief aim and object.

In the year 1902, at the Annual Meeting of the Canadian Mining Institute, this subject was introduced under the topic of "The National Importance of Mining," and discussed freely by many members of the Institute and some introduced guests, and the importance of the matter was thoroughly demonstrated. The C. M. I. had reasons for congratulation in the manner in which these suggestions were received by the Minister of the Interior and by the distinguished gentleman who now occupies the position of Dominion Superintendent of Mines ; at the same time it must be said that during two years which have since elapsed little or nothing has been accomplished by the Government in initiating such a department. The Review, in presenting this topic again to the attention of its readers and of the Government, is but emphasizing the points which were clearly made at the session of the Canadian Mining Institute just referred to. The necessity for a separate Department of Mines, associated, perhaps, with the Geological Survey, is greater than ever. The mining industry of Canada has grown in spite of the unfavorable influences of the boom period which existed from 1895 to 1900; to-day the mining industry of B. C. is on a sounder and safer footing than ever before ; to-day the mining industry of Ontario is solid, and has promise of far greater realization than it ever before enjoyed ; similarly the mining interests of the eastern Province of Nova Scotia are on a better footing than ever before ; the coal trade, the iron trade, and the gold mines of our easternmost province are to-day doing as well, if not better, than they ever did.

That the mining industry throughout the Dominion is steadily progressing is not due, in any sense, to any measures passed or initiated by the Government, but solely to the efforts which individual and private corporations have made. New and complex problems continually arise in the conduct of mining business, and they are problems which are never satisfactorily solved by men who are not equipped with knowledge for that purpose. Excellent citizens as the respective heads of Government bureaus may be, yet unless they are more or less experienced and trained in the line in which their duties lie, they must be more or less inefficient, and incapable of meeting the demands made upon them. The Department of Mines must necessarily be controlled by an experienced man, who need not (and should not) be a politician of any type, but should be a man with the quality of trained brain and with the experience that would ensure the proper discharge of his complex and trying duties, and who would inspire confidence among the mining fraternity. He should be a man familiar with the resources of the country from east to west, and with the needs of the industry ; he should be a man more or less personally familiar with all the different provinces and with the different needs and necessities of them, and, furthermore, he should not alone be a man of book-learning and of theoretical knowledge only, but a man who has had some personal and practical experience of the business difficulties which the various laws of the provinces impose to a greater or less extent upon the mining industry.

Lawyers expect the Deputy Minister of Justice to be a lawyer, learned in the profession, and experienced in the practice of law ; why should not the mining profession expect the deputy in charge of the Department of Mines to be a miner, learned in the theory and experienced in the practice of mining ? There is no reason why they should not, and the Review believes that the Hon. the Minister of the Interior fully and clearly recognizes that the head of such a department must be a man of such learning and of practical experience.

The Review imagines that the difficulty the Minister has seen is that it has been objected that, since the mines in the different provinces are under the jurisdiction of the respective mining acts of those provinces, the Dominion can not very well interfere with them, or undertake to manage or control a Dominion Bureau of Mines which should not have full jurisdiction. In so far as the adjudication of the various provincial laws is concerned, this objection is well founded, but the speakers at the Mining Institute meeting already referred to went beyond this narrow view, and while admitting that no conflict or interference was possible, yet showed clearly how the Dominion could greatly assist and help forward the mining industry without any reference whatsoever to the various and complicated laws which govern it in different parts of the Dominion.

As was remarked in one of the papers read at the Mining Institute meeting, the United States also has no jurisdiction in many of the matters relating to mining in the Western States; once a patent is obtained to a mining claim in a Western State, the future guidance of that mine is a matter of State regulation only. Yet no government in the world has spent so much money or given as much expert attention to the geology, methods of working, and collection of statistics as has the Government of the United States.

The necessity for a correct and displayed collection of facts relating to the mining industry, the equal necessity of maps clearly showing the geology, topography and physical characteristics of the important mining sections, the necessity of some Dominion law permitting the correct inspection of mining and metallurgical works, and the collection and tabulation of mineral statistics, were strong points that were made, but to the Review it seems as though an equally important point had not been sufficiently emphasized, and that is—the preparation of monographs upon the different commercial minerals, their occurrence, their abundance, modes of mining, and methods of metallurgical treatment ; above all other points this would appear to be one of the most important.

The Nicola Coal Field.

Great activity prevails in this section in consequence of the steps which the C. P. R. is taking to test its merits as a coal producing field, and the granting of a charter by the Federal Parliament for a railway to run from Nicola to Spence's Bridge. Five different corporations are busy prospecting in the district; two drills are at work on the Coldwater River, and another is on the way to this section, and so far the only coal discovered in workable quantity is of a low bituminous character, just a little removed from lignite ; there is, however, a probability that a good grade of bituminous coal may exist, as samples of such have been tested which gave as high as 60 per cent. of fixed carbon.

Dr. Ells, of the Geological Survey of Canada, has been detailed to make a thorough examination of the section, and has already arrived at Nicola. The result of his labors will be awaited with much interest, since good coal from this district would mean cheaper fuel for all purposes from Revelstoke to the Coast, and on all branches of the main line of the C. P. R. west of the Rockies.

Important Iron Ore Discoveries.

On Hooker's Creek and Gray's Creek, both of which flow into Crawford Bay, 25 miles east of Nelson on Kootenay Lake, a genuine body of high grade specular hematite has been discovered. It is contained in a ledge 20 feet wide, dipping at an acute angle between walls of dolomite and conglomerate. The strike of the ledge is N.W. and S.E., and it has been carefully prospected and located on nine claims, the original staker being George McMillan, an old prospector, and one of the Klondyke pioneers. Assays give 55 to 60 per cent. of iron, with traces only of sulphur and phosphorus; silica is rather high, but this analysis may be accounted for, both as to silica and sulphur, by the fact that all the samples were taken at the surface, affording chances for the diminution of sulphur and corresponding increase of silica. The property is very accessible and at a low elevation. Three miles of aerial tramway would suffice to land the ore on board barges on Crawford Bay. The significance of this discovery is that it clearly proves that the hematite deposits of the Goat River section are not confined to the narrow limits previously assigned. Although the Kitchener deposits do not extend beyond Iron Mountain, these later locations (20 miles to the north) are almost in a direct line, and go far to demonstrate the existence of a sufficient quantity of ore to justify the ultimate establishment of a steel industry in the Kootenays. No higher grade Bessemer ore exists on the continent than the Kitchener deposit, if it has any equal. Assay after assay taken across the ledge has given from 65 to 69 per cent of iron. The Hooker Creek ore, though of a lower grade, will work admirably with a pure ore like the Kitchener. There is abundance of limestone on Kootenay Lake, as well as in the immediate vicinity of the ore, and Fernie coal and coke would cost only $4 and $6 respectively, laid down in the neighborhood of Crawford Bay.

CORRESPONDENCE.

Patent Processes Again.

To the Editor:

Sir:—The man with a patent process usually finds a happy hunting ground in Nova Scotia. They turn up at irregular intervals, ply their wares diligently until they have succeeded in corralling as much local and foreign capital as possible, and then they retire to other fields, leaving in many cases monuments of folly in the shape of abandoned works.

The last exponents of the patent process in the field here are three gentlemen, who have leased a shop on Grenville Street, where they are demonstrating what is known as the Ryder Process, by which, as far as can be learned, they make the modest claim of getting 100 per cent. of everything of any value in the ore.

A visit to the show brought back the days of our school chemistry lectures. Here on a counter are arranged beakers, Wolff bottles, etc. The ore under treatment at the time was an auriferous antimony ore, which is placed in vats, in hydrochloric acid, assisted by heat from a pipe through which steam passes ; by this process the sulphide of antimony is dissolved, leaving the gangue, gold, and a small percentage of metallic antimony which occurs in the ore, undissolved. I was informed that the sulphuretted hydrogen formed by the treatment of the second batch of ore would be used to precipitate the chloride of antimony formed from the first batch, and thus practically no hydrochloric acid or sulphur would be lost. I assume they are relying on the following reactions: first, the dissolution of the sulphide, thus:

$$Sb_2S_3 + 6\ H\ Cl = 2\ Sb\ Cl_3 + 3\ H_2S$$

2nd. The re-precipitation of the sulphide, thus:

$$2\ Sb_2Cl_3 + 3\ H_2\ S = Sb_2S_3 + 6\ H\ Cl.$$

Unfortunately there is the anomaly about chemical equations which is misleading to the uninitiated. The first reaction takes place in fairly concentrated solutions, the second in comparatively weak ones. To bring the acid obtained from the second equation up to the strength required for the first equation means either the addition of considerable quantities of fresh hydrochloric acid or the evaporation of the dilute solution, and consequent loss of acid owing to the well-known fact that, on the evaporation of solutions of gaseous acids, certain quantities of the acid, varying with the strength of the solution, come over with the distillate.

Besides precipitating the sulphide, these gentlemen precipitate the metal from its chloride by scrap iron, and make pigments other than antimonious sulphide by the addition of various salts ; an array of beakers with other precipitates being on view.

Inquiry as to how it was proposed to save the gold from the residual insoluble matter appeared to somewhat raise the ire of the inventor, who informed me that he had not refused offers of professorships in the leading universities to come down to Nova Scotia to teach chemistry ; he did not, however, mention the names of these universities.

The operation of the dissolution of the ore is carried out in sealed tanks, and herein appears to be the only patentable part of the invention, which is evidently very wide in its application, as the inventor informed me, amongst other things, that it could be used in desiccating fruit.

The promoters of the Ryder process are wished success in commercially demonstrating the claims they make for their process, and when they have accomplished this, but not until then, they may deserve success in the formation of the local company which they are floating to run the process in the Maritime Provinces.

Yours truly,

NOVA SCOTIA.

Halifax, Aug. 22, 1904.

The Nickel Deposits of Norway.*

By Major R. G. Leckie, M E., Sudbury, Ont.

The similarity of the older geological formations of Norway to those of Canada was pointed out by Mr. Thomas Macfarlane, F.R.C.S., forty years ago, in a series of papers published in the "Canadian Naturalist."

The west coast of Norway is occupied by the Archean or Primitive, as it is there called, the equivalent of our Laurentian. Gneiss and granitic-gneiss are the prevailing rocks, the others occurring only subordinately. The serpentine (or ophiolites, as they are described by Dr. Sterry Hunt) of the Laurentian, like that of the Norwegian Primitive, carries no nickel, differing in this from the serpentine and peridotites of the Silurian. A peculiar series of Archean rocks, called the Teledmarken, is described by the Norwegian Geological Survey as "obviously clastic," such as conglomerates, sandstones and clay slates, but besides these rocks crystalline schists, gneisses, granulites and hornblende schists also occur. The strata are folded and often traversed by granite dykes. The students of ore deposits have been puzzled over the nature of these. The veins are described as true fissure veins cutting the vertical strata at an acute angle. These are silver-bearing, filled chiefly with calcite. The silver occurs only where the veins intersect the pyrites-bearing bands of the country rock. These are the Fahlbands described by Mr. Macfarlane.

The celebrated Kongsberg, "The King's Mountain" mine, occurs on one of these series of fissured veins. It has been worked for over 250 years, and yielded in that time 898 tons of fine silver, but the great fall in the value of silver has rendered operations in recent years quite unprofitable.

It is in the Pre-Cambrian and Cambro-Silurian that the deposits of copper, nickel and cobalt occur. The copper mines of Roros were started in 1646, and are to-day more largely operated than ever. The ore averages 5 per cent. copper, is smelted in water-jacketed furnaces, the matte bessemerised and brought up to 99.50 per cent. This is refined. The works are up to date.

The Sulitjelma copper mines in Saltém are of more recent opening, having been first worked in 1887. At present 30,000 tons pyrites are exported and 450 tons of refined copper produced at the works yearly.

The island of Ostero is the largest on the west coast of Norway, and is situated about eighteen miles north of Bergen. It is embraced in the great development of the Archean rocks, which stretch along the coast from Bergen on the south to Hammerfest on the north.

Several ridges, rising occasionally to a height of 1,500 feet, traverse the island from east to west. These are composed of syenite, mica schist, hornblende schist, gabbro and diorites. Over a length of five miles interbedded masses and lenses of pyrrhotite are found running subordinate to the stratification.

At Fieldskuldnaes, near the shore, three promising outcrops of ore occur, but no development work has been done other than removing the overlying soil. Continuing eastward on the strike, considerable development work has been done in the beautiful little valley of Littland.

A shaft has been sunk 100 feet on the dip of the vein, and also two trial pits—one to the east and one to the west—proving the continuity of the ore for a length of 800 feet. Here it has a width of from six to nine feet and a dip of from 15 degrees to 20 degrees. The pyrrhotite is not compact, but mixed with hornblende, feldspar and quartz. The ore pile at the shaft assayed 2.35 per cent. nickel and 1.02 per cent. copper. From the level of the little lake an adit level could be driven in which would facilitate drainage, and give a good back of ore when driven towards the rising ground.

About 600 yards north, on the shore of the lake, another vein is seen, but under water. The width appears to be about 7 feet of compact pyrite and pyrrhotite.

Ascending the ridge, and at a height of 800 feet above the sea level, No. 4 mine of the Noonas group is reached; then the continuation up to Nos. 2 and 3. Here the ore bodies are more broken and dip at an easy angle, from 10 degrees to 15 degrees. The ore in places is compact, of a bronze-yellow color, and at other points is scattered through the underlying diorite. Samples from piles ready for shipment yielded:—From Number 2, 2.15 per cent. nickel and 1.21 per cent. copper; from Number 3, nickel 1.85 per cent., copper 1.95 per cent., showing that there was a considerable proportion of earthy gangue present.

Number 1 workings are at an elevation of 1,050 feet above sea level. The ore-bodies are irregular and detached. The north or hanging wall side is largely composed of hornblende schist and mica schist, the underlying or foot wall side showing more gabbro. Some copper ore of good grade, running over 7 per cent., was shipped from here, but the nickel contents were low. The average of the shipments from this point, however, ran about 2 per cent. copper and 2 per cent. nickel.

A good waggon road from the wharf to the highest working has been built, while the ore from Numbers 2, 3 and 4 was conveyed by wire cable to the shipping point, a distance of 1,500 yards. The deposits at Littland and Fieldskulnaes are still more convenient to the wharf, where vessels of the very largest tonnage can lie in perfect safety in the well-protected fiord of Lonevaag.

South of Bergen about ninety miles, and about seven miles out from the harbor of Haugesund, lies the island of Foeoe. It forms one of the interesting group which protects seaward the entrance to Haugesund.

These islands are composed of granites, syenites, quartzites and schists. A deposit of compact sulphides has been opened up on the island of Foeoe, and about 4,000 tons of ore shipped. A vertical shaft has been sunk to a depth of 120 feet, and levels extended east and west for a total distance of over 300 feet; a winze has been put down near the face of the east level to a depth of 20 feet. These workings have been in ore all the way. The ore-body strikes east and west, and dips at an angle of about 45 degrees south. Its thickness is irregular, running from four feet up to sixteen feet, and lies conformable to the stratifications. It has the appearance of three lenses, whose ends slightly overlap, and their continuation in depth has not yet been determined. The country rock is rather fine grained gabbro, with narrow bands of hornblende schist interstratified on the north side.

The ore is hard and free from gangue. About 600 tons selected for copper were shipped to England, and yielded 8.50 per cent. copper. Two cargoes of run-of-mine were shipped to New York, and assayed 2.25 per cent. nickel and 2.25 per cent. copper.

The shaft is situated within 40 yards of the loading chute, underneath which vessels of 5,000 tons can load in any weather, as the cove is perfectly land locked. The facilities for shipping could not be excelled.

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* Paper presented at the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

In the southern part of Norway the important nickel mines which have been opened are those of Evje, Ringerike, and Askim.

The Evje mines are situated on the mountain range which forms the eastern boundary of the Otter Valley, at an elevation of 500 feet above the river. The geological formation is very similar to that described at Ostero and Foeoe. The schists are tilted to a high angle, and by contraction or lateral pressure have become corrugated, these corrugations running at right angles to the strike. The openings produced in the foliation have become filled with iron sulphides carrying nickel and copper, but sometimes a pinkish colored feldspar occupies the full width of the opening. Occasionally fine crystals of tourmaline are found in it. These ore deposits form, therefore, a series of lenses, more or less connected, or they may be described as a saddle reef, only instead of following each other vertically, as in the gold-fields, they form a series of saddles in horizontal series, somewhat flattened, so that the flaps touch each other. These may be described as the leaders, which guide the miner in following up the series of ore deposits.

The ore is of good grade, according to many analyses made by Messrs. H. H. Vivian & Company, who worked the mine for some years; the average runs from 3.30 per cent. nickel to 4.05 per cent., and 1.00 to 1.30 per cent. copper. Cobalt is always present, some assays showing as high as 0.50 per cent.

This ore is carted down hill about three miles to the river bank, where it is put on the roast beds and calcined. Care is taken to retain what we should consider a high proportion of sulphur, the object being to produce a matte from first smelting carrying 12 per cent. nickel and 4 per cent. copper. The loss in slags being kept down to .20 per cent. The matte is taken to the open hearth, where it is brought forward to a matte carrying 65 per cent. to 70 per cent. of the combined metals. An average analysis is given as nickel and cobalt 50.90 per cent., copper 17.00 per cent., iron 9.30 per cent., and sulphur 22.80 per cent.

The main shaft has reached a depth of 91 meters (290 feet). On the west side a face of good ore is exposed. On the 80 metre level a body of ore 16 feet wide by 13 feet high was being stoped; length undetermined.

Pumping and hoisting are effected by turbine, driven by a sixty feet fall of water, on the Odde River; the power being conveyed by wire rope. The works are situated near the falls of the Odde River, which furnishes power for all the machinery required. If this power were developed, it should be equal to 2,500 horse power. No mining location can surpass this for facility of cheap development. The ground is favorable for an adit level, which would give a back of 500 feet on angle of dip. The power for air-compressors, electric motors, etc., would be furnished by water power on the spot.

The mining district of Ringerike is one of the most beautiful in Norway. The Tyrifjord, with its surrounding mountains and numerous fertile valleys watered by clear mountain streams, reminds one of the impressive scenery of the Eastern Townships.

The railway runs up the charming valley of the Drammen to the Randsfjord and other great lakes stretching down from the north. The mines of Ertelien, Langedal and Stoverntangen have furnished the smelting works at Vaeleren with over 50,000 tons of ore. The cost of this delivered was about $1.75 per metric ton. The average contents was 2.10 per cent. nickel, 1.00 per cent. copper. Cobalt was usually present to the amount of 0.20 per cent.

Mr. Macfarlane, who spent several years in that district of Norway, says: "The fahlbands in the neighborhood of Ertelien and Ringerike have not been so carefully studied as those of Kongsberg and Skuterud, nevertheless it admits of no doubt that the nickel mines of the former locality occur on impregnated zones of rock like the fahlbands. The deposits are irregular masses of magnetic iron pyrites containing 2 per cent. metallic nickel. Although a definite veinstone is not observable, it appears from the presence of selvages in various places that the deposits partake of the nature of veins." From personal observations I am disposed to agree with this description, as the conditions under which these ore deposits occur, are different from those already described.

The ore is found interlaminated with the schist, and two tons have to be broken to furnish one ton of smelting ore. These schists dip at a high angle, and are cut in two places by diorite dikes. The surface workings extend over a length of half a mile. The ore is conveyed to the smelting works by wire tramway, and is treated in the same manner as that at Evje.

At the smelting works the plant is driven most of the year by water power. There is an abundance of wood on the company's estate both for mines and fuel as well as for building timber. Coke brought by rail from Drammen costs $5.00 a ton, and labor is abundant and cheap. The manager estimates that he could deliver 50,000 tons a year to a smelting works.

The cobalt mines at Skuterud, of which Mr. Macfarlane was for several years manager, are described by him as occurring "on a fahlband which has been traced about five miles, the rock being quartzose mica schist. Layers of impregnated hornblende and actinolite schist are also of frequent occurrence. The rocks run north and south, and have a dip nearly vertical; sometimes inclined slightly to the east, sometimes to the west. In these rocks the following metallic minerals have been observed:—Magnetic iron and copper pyrites characterizing the fahlband; cobalt glance; cobaltine; cobaltiferrous-mispickel; magnetic iron ore; graphite and molybdenite are found more sparingly, impregnating the fahlband at certain places. They seem to form a succession of small layers running parallel with the foliation of the rock. The fahlband itself has a breadth of from one to five fathoms."

These ores were crushed in a stamp mill and concentrated on percussion tables. The concentrated ore was roasted and smelted in reverberatory furnaces. The matte or Zaffre, containing about 30 per cent. cobalt oxide, was shipped to England, where it was manufactured into pure cobalt oxide and smalt.

The nickel mines of Askim are thirty-three miles by rail from Christiana and forty-one miles distant from the port of Fredrikstad, with which they are connected by railway.

The low mountain ridge of Romsaas, rises out of a very fertile valley to a height of 250 feet. The country rock is here similar to that of Ringerike, but is more broken and disturbed with diorite dikes. The ore occurs in detached masses, having a length varying from 30 to 60 feet, with an average thickness of six feet. Occasionally the vein or fissure is filled with feldspar and a little hyperstene. About 30,000 tons have been mined, one-half of which was picked out by hand for the smelting works. The average of this was 2.40 per cent. nickel and cobalt. Some of the ore was roasted and other lots smelted raw, so that the first matte was low grade and irregular, running from 5 per cent. to 7 per cent. This was roasted and subjected to another smelting, which brought the nickel contents up to 35 per cent. No attempt

at systematic development of the deposit has been made, although the location offers every facility for so doing. An adit level can be brought in from the low valley and the whole mineral zone cross-cutted.

The mineralized zone has a length of 350 yards and a width of 100 yards. A large concentrating plant would be required, and it is very doubtful if this could be made to pay at present prices of nickel and cobalt. The concentrates do not carry over 3.50 per cent. to 4.00 per cent. nickel and cobalt, with about 0.50 per cent. copper.

The Glommen River, the largest in Norway, tumbles over immense falls within 1,500 yards of the mine. A company has just completed a plant which develops 45,000 horse power, and is prepared to furnish electric current at the rate of $15.00 per horse power per annum.

It will be seen by the foregoing that although there are in Norway many extensive bodies of pyrrhotite carrying nickel and cobalt, yet they are too scattered and too low grade to successfully compete with the great mines of New Caledonia and Canada under present conditions. The particularly favorable position of Ostero and Foeoe for shipping ore to foreign markets, or for the importation of fuel, might enable them to be worked on a moderate scale.

The owners are hopefully waiting for the enforcement of the export duty on Canadian ore and matte, which they believe will again give Norway a large share of the European nickel market.

The Development of Coal Mining in Canada.

Contributed by WILLIAM BLAKEMORE, M.E.

Nothing in connection with the mining industry in Canada is more gratifying than the fact that, of all its important branches, coal mining is at once the most extensive and the most progressive. Prosperity in other departments has ebbed and flowed ; the silver lead industry has receded from its 33,000 tons in 1900 to 12,000 tons last year, only to start again on the up grade this year under the stimulus of the bounty and enhanced prices. Copper has fluctuated greatly both in tonnage and price, yet the unlimited possibilities of the low grade deposits of the Boundary have more than offset the heavy fall in tonnage and values in the Rossland Camp. The first flash of success in the Yukon has passed, and gold recoveries have fallen from $25,000,000 in 1898 to $16,000,000 in 1903. Coal alone has maintained a steady and practically unbroken record of increased tonnage, widespread development and enhanced profits. In ten years the output has risen from 3,783,499 tons to 7,996,634 tons.

The most gratifying feature of this development is that hand in hand with it have progressed the manufacturing industries which alone can build up a prosperous nation. The basis of all these is cheap and abundant fuel. It is this which first enabled England to become the pioneer of manufactures, and we have not yet ceased to marvel how nearly 200,000,000 tons of coal are mined annually in a territory smaller than Nova Scotia or any New England State. It is the same bountiful provision of nature which has enabled the U. S. to forge ahead and finally become a formidable competitor, not only of Germany and Belgium, but of the Motherland as well. That Canada will be able to follow suit is daily becoming more evident. To say nothing of textile manufactures, which perhaps depend more particularly on water power, take those lines which are inseparably connected with the use of coal for fuel and smelting purposes, the allied iron and steel trades ; in 1898 the total value of exported goods of this class was $606,082, in 1903 it was $3,263,940, or an increase of 500 per cent. Such an increase shows that the natural course is being followed in Canada, and that "pari passu" with the developments of coal mining the industries properly associated with it are keeping pace. This is the hopeful augury for the future of Canada, the forging ahead of the "secondary industries," as Mr. Chamberlain calls them. It would avail us little to produce pig iron, or the cruder qualities of iron or steel, if we did not proceed to their manipulation in finer form, calling out the intelligence and all the higher qualities of our people; and of this coal is the foundation.

We have suggested that it is abundant and cheap—let us see how far this statement can be verified.

Nova Scotia has, for upwards of 150 years, been a producer, but it has only been during the last 10 years that she has known any expansion. Now, instead of the General Mining Association of the Georgian era and the earlier Pictou mines, we have in the province more than 20 shipping companies, and an output which is rising by leaps and bounds. One company alone is likely to reach 3,500,000 tons this year, and at least four others have equal potential capacity. For the first time in her history she has exported coal to Europe, and, with English companies (which first exploited her mineral wealth) again entering the field, it is certain that in the near future Nova Scotia coal will be found cheaper for the purposes of English manufacturing than the deeper native seams, which alone will be available in the Old Country ; when that day arrives the annual output of N. S. will not be reckoned by millions, but by tens of millions.

It is nearly ten years since the Review first discussed the possibilities of such a development and stated that when N. S. coal could be delivered at British ports at $3.00 a ton, the demand would be practically unlimited ; this will be effected as soon as steel makers in England work their mines on this side, and eliminate the middleman's profit, and that is on the high road to accomplishment.

It must not, however, be thought that Canada looks alone, or indeed chiefly, to an export trade for the building up of the industry of the Maritime Provinces. The establishment of those gigantic enterprises—the Nova Scotia Steel Co. and the Dominion Iron and Steel Co.—are a sufficient reply to such a suggestion. The former has achieved a splendid success, and the latter will yet emerge from its difficulties to furnish crude material for many a workshop and factory.

In British Columbia, Alberta and the Northwest the outlook is still brighter, and this is a marvel, because at present it is only a pioneer country, with scarcely a single manufacturing industry started. Yet here we have the finest coking coal on the continent and every condition requisite (except population) for the development of a steel industry which would supply the West with products essential to the use of civilized communities—which are now being hauled 3,000 miles. The problem of population is rapidly being solved by the thousands who are pouring into the Northwest, and meanwhile instead of two mining companies on the coast, the Dunsmuir and the New Vancouver Co., and two small ones in the interior, with an output of 1,000,000 tons a year, we have to-day ten shipping companies, with a capacity this year of 2,500,000 tons, and at least five others developing. It is worth while noticing the distribution of these companies to illustrate the widespread character of their operations: the Dunsmuir and the Western Fuel Co. at the coast ; the Crow's Nest Pass Coal Co. at Fernie, Morrissey and Michel; the Alberta Coal and Railway Co. at Lethbridge; the McNeil Co. at Canmore

and Anthracite; the C. P. R. at three points, Banff, Bienfait (Assiniboia) and Hosmer ; the Western Canadian at Frank ; the International Co. at Coleman, to say nothing of at least as many more who have just started up in the Blairmore, Flathead, Elk and Nicola districts. Up to date these have supplied B. C. smelters, the whole of the steam and domestic trade of B. C. and the Northwest, the San Francisco market, and latterly the Montana and Washington smelters and railways. Every grade of coal, from anthracite to lignite, is being mined in the West to-day, and over an area 1,000 miles long from east to west, and 200 from north to south. Alongside the metalliferous riches of the Rocky Mountains nature has placed her best smelting fuel, and for hundreds of miles across the prairies—where, for ever, wheat raising must be the only industry—she has laid boundless deposits of lignite, suitable for steam and domestic uses. On the route of the Grand Trunk Pacific these are as plentiful as on the C. P. R., and it is doubtful if better coal has been found in the West than at Berkeley Falls. It is a matter of common knowledge how the Yukon is now mining its own coal, and there is no reason to doubt that as far east as to the Laurentians fuel will be found.

So far, however, Central Canada has no native coal, and the great industrial centres of Ontario have to draw their supplies from the United States. Luckily water carriage minimises this disadvantage, but it is nevertheless a handicap, and goes far to explain why Montreal, with its base of supplies in the Maritime Provinces, is rapidly distancing Toronto as a manufacturing centre, and takes—as it does this year—more than 1,200,000 tons of coal by the St. Lawrence route. Whether the deficiency will be ever made good by discoveries in Ontario remains to be proved. Assuredly relief must come—if at all—from Northern Ontario, and the survey being made by the Government in that section will be followed with the greatest interest.

The Exploration of the Ontario Iron Ranges.*

By A. B. Willmott, Sault Ste. Marie, Ont.

For the past few years there has been considerable examination and discussion of our Ontario iron ores. The geological similarity between certain belts in Ontario and those found south of Lake Superior has been recognized. It has been claimed, especially in old reports, that Ontario and Quebec abounded in iron of the finest quality. Our politicians, always desirous of flattering, tell us so to day. Yet the Hamilton, Soo and Midland furnaces notwithstanding much search, have only one large producer on which to draw to-day. In 1902 these furnaces consumed 93,000 tons of Ontario ore, and were forced to buy 94,000 abroad. Still I am inclined to think that our politicians will prove right in the long run, and that our lack of ore bodies is due to the fact that we have not sought them in the right way. We have numerous surface indications, the interpretation of which it is the purpose of this paper to discuss.

Geographical Distribution.—These iron ranges are found from the Lake of the Woods on the west, to the Ottawa River on the east. Just as we have the Menominee, Marquette, Gogebic, Mesabi and Vermillion ranges skirting the American shore of Lake Superior, so we have the Mattawin, Animikie, Nipigon, Michipicoten and Batchawana ranges skirting the Canadian shore. The location of these and many others, together with notes on them, are given by Professor Miller in a report published by the Bureau of Mines for 1902. The more important seem to be the Step-Rock-Atikokan, the Hunter's Island-Mattawin, the Animikie, the Nipigon-Long Lake, the Michipicoten, the Hutton, the Temagami and the Eastern Ontario.

Geological Range.—These iron ranges belong, with one exception, to the oldest geological formations. North of Lake Superior, as south of it, three iron bearing ranges are recognized. The oldest is that of the Lower Huronian ; following this the Upper Huronian, and the third, is the Animikie.

The only range found in the Animikie is that extending from Gunflint to Port Arthur and east. It is to be the subject of a paper before this meeting of the Institute, and will not be further described here. The Mesabi, the Gogebic and the Menominee ranges of the United States, together with a part of the Marquette range, are the geological equivalents of the Animikie. These ranges produce 75 per cent. of the ore of the Lake Superior region. We have as yet no producing mine in rocks of this age. It should also be noted that the Animikie rocks are confined to a small triangular area near Port Arthur, unless the shales and tuffs within the nickel belt at Sudbury prove to be of this age.

Upper Huronian rocks are more widely distributed. The typical area is that north of Lake Huron from the Sault to Sudbury and beyond. Wherever Huronian areas are shown on our geological maps future detailed work will probably show both the upper and lower divisions. The Upper Huronian, has, however, not proved prolific in iron. With the exception of the larger part of the Marquette range there are no producing mines in rocks of this age. About 16 per cent. of the product of the Lake Superior region for 1900 came from the Upper Huronian. The prospects now being worked in Deroche, and adjoining townships, north of the Sault, seem to be of Upper Huronian age. So also the mine in Aberdeen Township, from which several vessel loads of hematite were taken a number of years ago. The hematite patches in quartzite in the Townships of Long, Rutherford and elsewhere, on which some work has been done, are similar in appearance and of the same age. The ore is of high grade, but so far small in quantity. It should be noted here, for the benefit of anyone consulting American literature, that the Upper Huronian of Canadian writers is the equivalent of the Lower Huronian of American writers, they having wrongly correlated the Animikie with the original Huronian, whereas it is a later formation.

The lowest and oldest of the three iron-bearing formations, i.e., the Lower Huronian, is much the most widely distributed in Ontario. It has given us our only producing mine of any size; and our most encouraging prospects are in rocks of the same age. South of the line the Vermilion range is of the same age, and a few small, worked-out properties on the Marquette range also belong here. In 1900 less than 9 per cent. of the Lake Superior production was of Lower Huronian origin. With the opening of the Helen the percentage was somewhat increased.

It is in rocks of this age that our main supplies will, I believe, be found. The occurrence of the iron belts, their form, composition, etc., thus become of great economic interest. In every area shown as Huronian on our geological maps, wherever in the region of the Great Lakes the green schists are found, there also have been found, or will be found, the sediments of the iron ranges. These may be small in extent,

*Paper presented before the Sixth Annual Meeting of the Canadian Mining Institute, March, 1904.

representing only the last remnants of a large area, or they may be a long and narrow belt. In no case has a band half a mile in width been found. Usually there are a series of lenses arranged for the most part in a row, or occasionally in a few parallel rows. At other times the iron belts persist for many miles, in long, narrow bands enclosed on either side by green schists. The Hunter's Island and Mattawin belts are good examples. The Nipigon Long Lake range is perhaps continuous for seventy miles. The Michipicoten range is nearly as long, but is frequently interrupted.

Character of the Rocks.—The Lower Huronian rocks of the Vermilion and Michipicoten ranges have been somewhat carefully studied, and may be taken as characterising the other ranges. At the base of a series in both regions there is a massive greenstone, ellipsoidally parted ; this is the oldest known rock of the Lake Superior area. Overlying this is the iron formation. Later are intrusive granites, porphyries and greenstones. The whole have been bent in great longitudinal folds and closely pressed. The original sediments now stand nearly vertical. The massive greenstones have now a cleavage developed in them by pressure which corresponds closely with the bedding of the sediments. Metamorphism has so changed many of the latter that it is now difficult to distinguish some of the greenish sediments from the schistose greenstones. The comparatively thinly bedded sediments, when upturned on edge, make quite narrow bands in the older greenstone schists, even when doubled, as they probably are in most cases. The longitudinal folding sometimes produces one belt ; sometimes several parallel ones.

In addition, a transverse folding has usually taken place, crumpling steeply the longitudinal fold. The bottom of the longitudinal fold, could we see it, in place of remaining straight has been bent into a series of hills and valleys. So also the top, but denudation has in most cases destroyed the surface appearance. Usually the hills resulting from the transverse folding have been cut down more than the valleys; in some cases until they have entirely disappeared. In the Michipicoten area the iron range hills now standing are, in many cases, the bottoms of the transverse valleys. It is in these cases useless to drill in the green schists between two iron formation outcrops with a view of finding a buried portion of the iron range.

The iron range rocks have been frequently described. They include iron carbonates, ferruginous cherts, pyritic chert, banded ore and jasper and lenses of ore and of pyrites. Banded jaspers and cherts are the most common and the most characteristic. Carbonated schists are commonly associated with the iron formation in the Michipicoten region.

Formation of Ore Bodies.—It has been conclusively proved by Van Hise and his associates on the United States Geological Survey that the lake iron ores are the result of concentration by descending waters. The source has in most cases been iron carbonate, though iron pyrite in the Michipicoten and iron silicate in the Mesabi have been important factors. Ores seem to have been concentrated in every case in an impervious basin. This in the Lower Huronian, is usually the upper layer of greenstone underlying the iron formation which has been folded in a trough. Transverse folding has made the trough a basin. Such would appear to be the case at the Josephine and Frances in Michipicoten and at the Chandler in Minnesota, and elsewhere. It is also true of the Helen, though at this mine there is a second cause at work.

Basins are also made by impervious layers of slate within the iron formation itself. These frequently defeat their usefulness by making several small basins instead of one large one.

Dikes cutting across the formation, particularly where a pitch occurs, frequently form one side of a basin. This is true of the Helen in part. A dike crosses the formation at right angles, dipping perhaps ten degrees in the same direction as the formation pitches. As green schists undoubtedly form the bottom of the trough, an impervious basin should exist on the side where they meet in an acute angle. There is some ore here beneath the bottom of Boyer Lake, how much is not yet known. The main body so far discovered, however, is on the opposite side of the dike, i.e., the dike forms the footwall. Several dikes of similar character cross the iron formation near Iron Lake. One of the best surface shows on the Michipicoten range occurs in connection with one of these.

Favorable Indications.—From a consideration of the above facts and theories regarding the formation of iron ore bodies we are led to the following conclusions regarding surface indications:

(a) An impervious basin of schist or greenstone surrounding and underlying the iron formation is favorable. This basin can frequently be seen at the ends of the shorter belts, as at the Helen, Josephine and Frances. The central parts of the longer belts are not likely to give definite evidence on this point.

(b) If the basin is in the form of a pitching trough it is still more favorable. On the strength of this and other reasons drilling was carried on at the Frances and at the Josephine and ore bodies located far below the surface.

(c) The crossing of the iron formation by a dike is favorable, as it may chance to form one side of an impervious basin. At any rate it has promoted the circulation of water by fracturing the formation.

(d) Contact planes, either within the formation, or between it and other formations, are favorable, because here movement has frequently taken place and the circulation of water promoted.

(e) The more broken and crumpled the jasper and chert the better, because circulation has here been good.

(f) The less the amount of iron in the banded jaspers on the surface, the better the prospect of finding ore in the bottom of the basin. A regularly banded jasper and hematite is not likely to have been concentrated downwards.

(g) The presence of any carbonate of iron is an unfavorable sign. It shows that concentration is not complete, perhaps not begun. It is true there is a large amount of siderite adjoining the Helen on the east. The ore has, however, been made, I think, from what was the continuation of this hill of siderite westward over Boyer Lake. At the Josephine no siderite occurs in the numerous drill cores on the islands in the lake. Nor does siderite occur in the Frances outcrops or cores.

(h) A sufficient width of iron formation is necessary. One hundred feet is too narrow to yield an ore body of any size; four hundred is better. The Helen formation is over nine hundred feet; the Frances, six to nine hundred; the Josephine, two hundred and fifty feet at a depth of four hundred feet.

(i) The presence of impervious layers of slate, etc., in the iron formation is unfavorable. The result is to make a series of basins each one too narrow to produce any large concentration. The Michipicoten range at Iron Lake exhibits this character. No deep work has, however, been done to prove the underlying basin.

(j) The points where the iron ranges cross low ground are the most favorable. Van Hise states that experience on

the south shore of Lake Superior shows that the ore bodies are found below the crests but above the low grounds. In Michipicoten the lowest points on the range have proved most favorable at the Helen, Josephine and Iron Lake. At the Frances there is an isolated hill of ferruginous chert rising 200 feet above a level plain. Ore has been found nearly six hundred and fifty feet below the top.

(k) The presence of magnetite is an unfavorable symptom. In very few mines on the south shore of Lake Superior is the ore magnetic. In the Michipicoten range, where magnetite is found, intrusive granites or other igneous rocks occur. These intrusives are mostly of Upper Huronian or Keweenawan age. Little concentration took place before these intrusions, and apparently none since. So also in the Mesabi range, the Keweenawan overflow prevented the formation of merchantable ore bodies in the eastern part of the range. The same condition probably operated in part of the Port Arthur district. Because an iron range is magnetic is, however, not sufficient ground for condemning it. On the contrary, one of our best ranges, that of Hutton, is mainly magnetic.

Methods of Exploration.—Assuming that a given area of country is to be prospected for iron, I believe the following things should be done, and in the following order:

(1) Determine the geological boundaries of the different formations, particularly of the lower Huronian.

(2) Cross the latter, at right angles to the strike, at intervals of a mile. Wherever any indications of the iron ranges are found this interval should be reduced to one quarter of a mile. The valleys of streams should be examined for boulders of iron and of banded jasper. From a boulder found in the valley of the Magpie River I was able to point out in my first report on Michipicoten that iron rocks similar to the Vermilion range occurred in the district. A dip needle should be carried, but I do not believe it worth while to make notes of the readings, and a map unless something of value is found. Where the intervals are reduced to a quarter of a mile an attempt should be made to get complete sections.

(3) The iron range found, an accurate geological and topographical map should be made. This should show the outcrops of rock, the kind, the strike, dip and pitch, the length and width of the iron formation, dikes, if any, the position and depth of the basin, if possible. This last is a most important point, but also a difficult one. The pitch of the basin can sometimes be inferred from that of the cleavage of the adjoining schists. Again, the direction of the opening of the V-shaped banded jaspers is a guide.

(4) Surface stripping should be undertaken while the geological map is in progress. This form of development is enormously cheaper than rock work. To say nothing of the assistance derived from it in determining the geological structure of the location, this superficial work is just as likely to locate ore bodies as are hollow shafts put down at random. It is well established in the Lake Superior area that all ore bodies somewhere reach the rock surface. Surface work should uncover the contacts and other likely points for ore deposition. Rock work, because of its greater expense should not be started until thorough trial has failed to find ore at the surface. If ore is found it should be followed.

(5) If an ore body is not found, and the indications are favorable, deep work must be undertaken. This will usually be the condition. A choice must be made between shafts and tunnels and diamond drilling. The latter is usually to be preferred because

(a) It proves ground to a given depth cheaper, and

(b) It does the work much faster.

It is to be remembered also that the prospect shaft will, in most cases, turn out to be very poorly located for economical mining, and is apt to be discarded. There is a great advantage in knowing the shape and size of an ore body before locating the shaft and installing the surface equipment. This knowledge can certainly be got best by means of a drill.

(6) The location of the holes is of prime importance. The first ones are naturally directed to finding ore; the succeeding ones to determining quantity. Ore is most likely to occur along the sides or bottom of the basins and along dikes or other planes of contact. As the schists which surround our iron formations can be drilled two or four times as fast as the banded jasper it usually pays to locate holes in the schists crossing into the jasper near the point which it is desired to reach. Vertical holes, parallel or nearly so with the bands of jasper, are to be avoided. They are very expensive to drill, and the record brought from a band of ore, say, two inches wide, is very deceptive. The crossing of the banded jaspers at a high angle is safest. To reach the bottom of a basin of unknown depth, probably the best way is to put down several holes from a point to one side, at successively higher angles. The depth to which these infolded iron formations go is surprising. At the Josephine the iron formation is less than three hundred feet wide, but it has been proved to a depth of seven hundred and fifty-eight feet below the lake level, and may go much deeper. At the Frances, the total length of the iron formation is 1,450 feet and the maximum width nine hundred feet. This short and narrow lens in the schist has been proved to a depth of over eight hundred feet, and may go further.

In both these cases ore has been found by probing for the bottom of the basins. At the Josephine there was no ore visible at the surface, and the banded cherts in the islands of the lake were most impoverished. At the Frances a small pocket of ore out-cropped, which soon gave out in depth. In both cases theory said test the basins, and in both cases ore was found.

This is what I meant when I said at the start that our lack of ore bodies was because we did not look for them properly. There has been, during the past two years, some intelligent and systematic explorations of the Steep Rock, Animikie, Michipicoten and Hutton ranges. In most cases, I am glad to say, this kind of work has resulted in the discovery of ore bodies. The amount of work of this kind done in Ontario, on all our ranges together, is trifling, compared with that done on the Vermilion range alone, between Tower and Ely, a distance of twenty-five miles. The time has gone for running through the woods with a canoe and a pick. We have found our iron ranges, and in large numbers and great size. The question now is: What is in the bottom of them?

The Crow's Nest Pass Judgment.

The following is the text of Mr. Justice Martin's judgment in the matter of Leadbeater vs the Crow's Nest Pass Coal Company:

Five test actions were consolidated by agreement, and evidence given in support of two charges of negligence by the defendant:

1. The use of a bonneted Clanny lamp, which, it was contended, was defective and not a "locked safety lamp."

2. The accumulation of dust to a dangerous extent.

In regard to the first, it is sufficient to say that it was clearly established that the type of lamp so used, while not perfect (which, indeed, no safety lamp in reality is), yet is in

very general use, and reasonably fulfils the statutory requirements. This was, in fact, practically conceded on the argument.

In support of the second charge the plaintiff advances the theory that the explosion was essentially one of coal dust ; while in answer to that the defendant company maintains that, as in every explosion in a mine of this nature, dust may have participated in it to an immaterial and unascertainable extent.

In support of these conflicting theories a great body of evidence was adduced in a trial lasting more than three consecutive weeks, and even if it were desirable for me to do so when discharging the functions of a jury on pure questions of fact (and I do not think it is), it would be almost an impossibility to attempt to review in detail all the evidence which I have listened to and weighed in a trial of such duration and complexity of fact, though not of issue. Dealing with such explosions as these, it is manifest that there is much that must remain a mystery, for no witness has been bold enough to thoroughly understand the forces of nature when disturbed by man in such undertakings as those under consideration, or give other than a speculative account of the cause of ignition, or even fix upon the precise locality of the explosion's origin. But approximately I have no reasonable doubt that some unascertained point in McDonald's level must be taken to be the place of such origin.

The next fact to be determined is, was it a gas or dust explosion? In arriving at a conclusion on this vital point, wherein science plays so great a part, the court is very largely in the hands of experts, and, in determining what weight shall be attached to their testimony, will be guided by their apparent competency and disinterestedness. Applying, then, the opinions of these witnesses to requisite facts which have been proved to my satisfaction, I am forced to the conclusion that on the evidence it must be held that this was essentially and substantially a gas explosion ; and of such a nature and extent that, quite apart from any possible augmentation by dust, it was alone sufficient to cause, and consequently must be held to have caused, all the results which the plaintiffs necessarily assumed the onus of attributing to a dust explosion. In this relation I think it proper to say that I accept as substantially correct the defendants' contention as regards two facts of paramount importance, viz., (a) the state of affairs at the overcast ; and (b) in the main entry generally ; and largely as a consequence thereof I am satisfied that the explosion properly so called did not pass through the main entry; though, if the dust theory be accepted, that is the place of all others throughout the length of which it must have passed in the condition of that mine. There is nothing, in my opinion, in the conclusions of the coal dust committee (second report, 1894, p. viii.), which, having regard to the circumstances of this case, conflicts with this view ; though it is apparent that there is still much to be learned on the interesting and important subject of dust in coal mines.

Such being the opinion I have arrived at, it is not necessary to consider any other matters, which become immaterial, nor to refer to cases cited, because on the above facts so found no negligence can be attributed to the defendant company.

It follows that the test actions must be dismissed with costs.

The Custom Smelting Industry in Mexico.

By James W. Malcolmson. Reprinted from the Lead and Zinc News.

The rapid growth and development of the silver-lead smelting industry in the Republic of Mexico was due primarily to the Windom decision in 1892, imposing a duty of one and one-half cents per pound on lead in ores imported from Mexico into the United States. The result of this decision was that over $35,000,000 has been invested in silver-lead smelting enterprises in Mexico, and large profits have been made ever since ; incidentally, it might be mentioned that treatment rates on silicious ores in Colorado went up $1 to $2 per ton on account of the reduction in the supply of lead coming there from Mexico.

Before the customs smelters were established in Mexico in 1891-2, the larger proportion of the ore was treated more or less unsatisfactorily by local methods at the points of production, but to-day most of it is shipped to the smelters. Between 80 and 90 per cent. of the entire silver and gold production of Mexico is founded in silicious ores, and it is in the purchase of these ores that the greater part of the profit is usually obtained in custom smelting.

At the present time all custom smelters are operated at their full capacity, and new furnaces are being erected, but the development of the silicious gold and silver mining industry has gone far ahead of the available furnace capacity. Ores containing the precious metals in association with lead, lime and iron or manganese are scarce, and as they usually contain little gold or silver, it is never possible to impose a high treatment charge, even when there is a scarcity of silica. Better prices are being paid to-day to the miners of lead ores and of lime and iron fluxing ores than ever before. The demand for such ores is far in excess of the supply ; barren iron is shipped to the smelters from the deposits of iron stone at Durango, Monterey and Jalisco, while limestone is quarried in the vicinity of the smelting plants.

Treatment rates on silicious ores have been raised to such a degree that many mines have been shut down, and prospecting is now at a low ebb.

The condition of the lead mines in Mexico to-day is causing the custom smelters considerable anxiety, and many thousands of dollars are being spent by their mining departments annually in search for lead or silver-lead ores. Every inducement is given to the independent producer to mine these ores, and treatment rates are very low ; but the lead shortage appears to be permanent. Throughout northeastern Mexico, in Nuevo Leon, Coahuila and Chihuahua, the lead mines are gradually becoming less productive in depth, or they are changing into a leady zinc ore, sometimes in the form of carbonate and sometimes sulphide. It seems quite impossible to separate zinc from lead carbonates, and, although a large amount of money has already been spent on magnetic and wet methods of separation of the closely grained lead and zinc sulphides, the results obtained so far have not given any satisfactory return on the investment. In magnetic separation, the first cost of the plant is extremely high, and the daily output so limited that it is not profitable to separate lead from zinc sulphides low in gold and silver values. On account of the chronic shortage of lead ore and the unsatisfactory character of the lead ores now being mined, one of the leading smelting companies has definitely abandoned, at Aguascalientes, the use of lead as a base or collector of the gold and silver contents of the smelter charge, substituting copper matte for that purpose.

The advantages which copper matte has over lead as a vehicle for the concentration of the gold and silver contained in silicious ores are numerous.

1. A lead furnace of standard size will smelt from 100 to 150 tons of charge (ore and fluxes) daily. The same furnace, when altered and operated as a copper furnace producing

copper matte, will smelt from 200 to 300 tons of charge per day, thus doubling the capacity of the plant, with practically the same investment in construction.

2. A lead furnace must necessarily run at a low temperature to prevent metallurgical losses, the slag must be more fusible and more carefully regulated than in a copper furnace. A typical lead furnace slag will contain 34 per cent. silica, 21 per cent. iron (FeO), 23 per cent. lime. A copper matte furnace is operated at a higher temperature than a lead furnace, and less attention is necessary in forming the slag; the iron and lime percentages may be altered within wide limits, according to the ore supply, and the furnace charge may carry as high as 50 per cent. of silica. In custom work it is desirable to carry as much silica and as little iron on the charge as possible, on account of the condition of the ore supply. A high percentage of lime also makes a light slag, which separates rapidly and thoroughly from the heavier matte carrying the silver and gold.

A modern copper matte furnace slag will contain 45 per cent. silica, 15 per cent. iron, 28 per cent. lime. In other words, in a lead furnace smelting 125 tons of charge with 34 per cent. silica in 24 hours, 42.5 tons of silica will pass through the furnace, while with copper matte, smelting 250 tons charge per day, containing 45 per cent. silica, 112.5 tons, or nearly three times as much silica, can be handled in the same time.

3. Sulphur in ores smelted in lead furnaces must be got rid of by preliminary roasting, at an increased cost of $2 to $3.50 United States currency per ton ; in matte furnaces this sulphur is utilized in the copper-iron matte produced, the cost of roasting is eliminated, and with an excess of sulphur, as there usually is, the coke consumption is reduced, part of the sulphur being utilized as fuel.

4. Copper matte is a more efficient collector of the precious metals than lead, and copper can be enriched with gold and silver to a much greater degree than lead, without loss. Silver lead bullion is usually exported from Mexico containing 10 kilograms of silver and gold per metric ton ; copper bullion can be enriched safely to contain 20 kilograms of silver per ton, and therefore only one-half of the amount of copper is required to the ton of charge.

The increase in the production of copper in Mexico is noticeable. In the year 1850, the production of the entire globe was estimated at 30,000 tons ; in 1891 the production of Mexico was 900 tons ; in 1903 it was 48,000 tons, equal to one-fifth the output of the United States.

Of the 1903 production of Mexican copper, 35,000 tons came from northern Sonora. The copper from Sonora, like the lead from the northeastern part of the republic, carries very little gold or silver. The copper exists as sulphide, which is concentrated and reduced in blast furnaces to matte. The matte is bessemerized without enrichment, and the bullion, assaying 99 per cent. copper, with very low gold or silver contents, is shipped to the refineries of New Jersey. Mr. James Douglas, in an article on Arizona copper mines, mentioned that the new Copper Queen works at Douglas, on the Mexican frontier, were being designed to take custom ores of copper, gold and silver, and added that "though there is no intention of invading the market for lead, it is the intention of the Phelps-Dodge Company to enrich the copper bullion with gold and silver," hoping to secure ores from Mexico.

It is not possible, however, for the Nacozari, Cananea or Douglas smelters in or near Sonora to reach the silicious gold and silver ores of Mexico, which are so badly in need of smelter facilities. These ores are not in northern Sonora, but are found at Parral, Guanajuato, Pachuca, Zacatecas, Catorce, Durango and Oaxaca, on the central plateau of Mexico, and it is inevitable that the Sonora iron-copper mattes, instead of being bessemerized and shipped as at present by way of El Paso, Texas, overland to New Jersey, will in future be shipped to railroad centres in the central portion of Mexico, and there used as a collector of gold and silver, when they will resume their journey via Tampico by sea to New Jersey.

While the recent announcement of the intention of the American Smelting and Refining Company, the owners of the copper smelter at Aguascalientes, to secure control of the Cananea Consolidated copper mines in Sonora, is probably premature, it is an indication of the desire of that company to control a supply of copper sulphide, and when it is remembered that last year the Aguascalientes smelter made a greater profit than all the smelters in Colorado put together, the importance of permanent control of copper sulphides as a base for operations, whether in the shape of high-grade ore, concentrates or matte will be appreciated.

In view of the fact that it is desirable to change the present transport of Sonora copper so that it will pass the silicious centres of the Mexican Republic on its way to the eastern refineries of the United States, the Government has under consideration a tax on the exportation of copper bullion without precious metal values and on ores or concentrates high in copper only, which will be removed after the copper is enriched before final exportation.

Probably the movement of copper mattes from Sonora and Southern Arizona to the gold and silver districts of Mexico will finally take place in any event, and the present unsatisfactory gold and silver situation will be relieved permanently, but the contemplated action of the policy of the United States will materially hasten the change. At the present time the movement is just commencing, and profits on silver-gold custom smelting operations using copper as collector instead of lead, will probably be large for some years.

Coal Dust.

"How best to guard against the dangers of dry coal dust in underground workings is a subject beset with difficulties. The mining inspectors have had the subject before them at several of their meetings without any definite result. This is not the fault of the inspectors, but because it seems impossible either to clear the dust out of the mines or to keep it constantly in such a damp condition as to be innocuous. The quantity of dust made in some seams is immense, and scattered over a wide area of the workings. The dust collecting on the main roads can alone be practically dealt with, and this is all that has hitherto been attempted. In such parts of the mine the quantity can be diminished somewhat by watering the surface of the coal in the trams before they leave the inner workings, and adding salt to the water makes this expedient more effective; something can also be gained by seeing that the trams, when made of wood, are kept dust-proof by good joints between the boards, especially the joint where the lowest sideboard rests on the bottom of the tram. It is at this joint that the greater part of the dust escapes, but when all these precautions have been taken the roads are still dusty, and watering and removal have to be constantly resorted to. Standpipes at intervals, to which a hand hose can be attached, has

been found to be the best practical method of keeping the roads damp. This subject of damping has recently become even more difficult and complicated in consequence of statements from Continental coal fields that spraying mines with water very materially facilitates the spread of ankylostomiasis."—Iron & Coal Trade Review.

The Canada Corundum Co.

The Canada Corundum Company, which has from the Ontario Government the right to first selection of corundum-bearing properties in the corundum-bearing areas, has about completed a new 300 ton mill at its works at Craigmont. The company has had in operation a 40 ton mill for the past three years, but the demand for its products has become so extended that greater facilities have become imperative. It has purchased a controlling interest in the Hart Emery Wheel works at Hamilton, which will be enlarged and made the largest corundum wheel works in Canada. D. G. Kerr, of Almonte, has been secured as mine manager. The company is shipping largely to the United States, France and Germany, and now has its own offices in Paris and Berlin. The company has deposits in the townships of Raglan, Radcliffe, Brudenell, Carlow, Dungannon, Sebastopol and Monteagle, that in the latter township being blue, akin to the sapphire, and very superior in quality. It is so situated that the ore can be brought to the present mill by water. At present the mill is turning out 12 tons of corundum a day, which will be doubled in a short time.

Tin in South Africa.

It is reported that the vast mineral wealth of South Africa has received an important addition by the discovery of lode tin. Tin has been for some time a dream of the prospector. The supply at present by no means equals the demand, and the price of the metal is therefore high. It is quoted at £120 (about $600) per ton, and there is no apparent reason why it should fall from this. Tin ore is also easy of reduction. The metal is found combined only with oxygen, forming the mineral cassiterite from which the pure metal is easily extracted. The mineral has been found in three different places in the new colonies, and promises to be a source of great revenue.

The London Critic says that an Antipodean expert is raising an alarm as to the future of some of the great copper and lead companies. Official figures, he submits, suggest that the end of many of these mines as large producers is near. Comparatively few of these mines, of course, supply the bulk of the world's copper and lead. For example:—

In 1900 Colorado had eight mines producing 80,000 tons lead, including the Lake mine with an output of 24,000 tons. Five Broken Hill mines produce 120,000 tons lead from approximately 1,200,000 tons ore. In copper, such producers as the Anaconda, United Verde, Calumet and Hecla, and Rio Tinto are down to very deep levels, and waste dumps and tailings, are becoming used up. To get much metal from very poor ore soon tells a tale. New discoveries are made infrequently. On a 10 per cent. basis of recovered lead from each ton of ore, Broken Hill at present rate would exhaust 12,000,000 tons of ore in ten years ; and it takes that much to maintain the world's lead supply for less than 18 months.

Therefore, the gentleman concludes, "as a whole, consumption is rapidly outpacing development; and must produce a highly speculative range of prices."

Mr. J. H. Curle, author of The Gold Mines of the World, writing in the "Scotsman," surveys the principal gold mines of the world, forecasting that this year the production will be larger than ever before—viz., about £70,000,000. "About £50,000,000, in equal parts, will come from South Africa, Australasia, and the United States, and the next largest yields will be from Siberia, India, Mexico and Western Canada." The Transvaal, he believes, will soon produce an average of £25,000,000 a year; and he looks to the high-water-mark of the world's gold production being reached about five years hence.

Appraisal of the Value of Coal Lands.

By H. M. CHANCE, Philadelphia, Pa.

(To be read at Lake Superior Meeting of the American Institute of Mining Engineers, September, 1904.)

In recent years an important function of the mining engineer has been the appraisal of the value of mining properties required by those planning consolidations of a number of individual operations.

In no field of productive industry have the economic results attainable by consolidation been more clearly shown than in the mining regions of the United States. In many important mining centres unification of ownership of the most valuable properties has already partially or completely been attained, and in other districts projected absorptions and consolidations await only favorable financial conditions for their consummation. The coal mines of Colorado, of Wyoming and of Utah, the anthracite mines of Pennsylvania, the Connellsville coking-coal mines, and large areas of bituminous coal land in Pennsylvania, in Ohio, in the Indian Territory and in other portions of the United States, are now largely controlled by a few corporations operating on a large scale, or by a number of corporations working in harmony because of an affiliation and inter-leaving of interests.

The tact of keen financiers and the diplomacy of men of great administrative ability are the chief operative forces in conceiving and accomplishing such consolidations, but in formulating and maturing them the services of the mining engineer are often required to supply the facts upon which they must be based. For this purpose the expert is expected to furnish full and complete reports covering the quantity of ore, coal or other mineral available, its value per ton, cost of mining and treatment, etc.

The paucity of literature covering this field of work may be attributed to the fact that experts reporting upon coal property, under past economic conditions, commonly have not been expected to include such an appraisal as a part of the report covering the property. The function of a mining en-

gineer or geologist generally has been to examine undeveloped property, reporting to intending purchasers the thickness, quality, number and yield per acre of workable coal beds; the purchaser determining whether the price asked for the property is satisfactory. In recent years, since the consolidation of developed properties has been in vogue, the engineer more frequently has been called upon for appraisals of the commercial value of going concerns, including the value of land, plant and improvements, and the good-will of the business.

In many cases this work is divided between the geologist, the consulting mining engineer, the constructing engineer and the expert accountant; each of whom, separately or jointly, is asked to report ; the first upon the quantity of workable coal ; the second upon the cost of mining, capacity of mines and value of improvements and developments ; the third upon the value of plant and outside equipment ; and the fourth upon the cost, return and net profits as shown by the operating company's books. These reports furnish material from which the financier may determine the relative values of the properties under consideration, and what sum they are fairly worth. To use this information intelligently requires sound business judgment, for the price asked by the vendors must always be greater than the aggregate value of land, plant and improvements shown by these several reports, because it includes a sum representing the value of the "good-will" of the business, or its "position in the trade."

The engineer actively engaged in the development or management of coal properties rarely has such relations with the financial management as qualify him to make commercial appraisals ; and to a recognition of this fact must be attributed the practice of some financiers in relying upon their own judgment in reaching conclusions concerning the value of coal property. Doubtless, in a majority of cases, the financier is the best judge of commercial value, and if supplied with the necessary data covering acreage, quality, yield per acre, cost of mining and past profits, his conclusions are generally correct. But that grave errors of judgment may occur through misinterpretation of the facts presented by the engineer, or through a failure to grasp important economic conditions, is evidenced by excessive prices sometimes paid for coal property, and the consequent over-capitalization and bonding.

Therefore it is essential that the engineer should qualify himself for undertaking the commercial appraisal of coal properties, because much work of this nature will be required in all of the important coal mining districts before the consolidation of interests is complete in each district. To do this work efficiently he must add to his training as an engineer, a knowledge of the economic conditions affecting the cost of production and transportation, the element of competition, the market possibilities, and something of the acumen of the trained man of business—"the man of affairs."

The purpose for which an appraisal of mineral property is desired will determine the choice of method or combination of methods to be used. If it be desired to ascertain the price that can be realized for the property and franchises of a corporation, if these be disjointed and separately sold, the method must differ from that employed when the object is to determine the real value of the properties to owners capable of profitably operating them. At the outset it is usually possible to eliminate from consideration the methods based upon forced-sale valuations, first, because such valuations are commonly untrue, erroneous and misleading, and, second, because modern business methods rarely permit the owners or creditors of large properties to consider disintegration, the course adopted almost invariably being to preserve the integrity of such properties unimpaired, because of the larger profit and greater value obtainable from them as a whole than could be realized in the aggregate from the several parts. Other methods have been applied to problems of this kind, among which the following may be noted:

1. A method occasionally used in the past is to determine the value by adding to the cost of the land the cost of the improvements and a reasonable remuneration to the party which has successfully developed the property.

2. A method modelled after the common practice of real estate appraisers is to determine the value by prices at which property of similar character in the immediate neighborhood has recently been sold.

3. A method ably elaborated by Joseph S. Harris several years ago for the purpose of appraising the value of coal lands owned by the Philadelphia & Reading Coal & Iron Co. has been adopted by many experts for general purposes. By this method the total workable coal in the ground is first determined, and valued at a certain sum per ton, this estimate being based either upon what the coal would produce if leased upon a royalty, or upon the profits of mining it. Using as a basis the rate of increase in production, as shown by past experience, the probable yearly increase of output is calculated, and from these figures the probable revenue is calculated for each year of the period during which the assumed output can be maintained, or until all the coal is mined. Then the probable future earnings of the land, either by royalty or through operation, are capitalized at their present money value, by the usual formulas for deferred payments, at a certain assumed rate of discount. In his report on the coal lands above referred to, Mr. Harris clearly shows that the present money value of coal land depends largely upon the time at which development is to be commenced, the time elapsing before maximum output is attained, and the time to be occupied in exhausting the tract,—the present money value decreasing rapidly as any of these variables is increased.

4. Another plan more generally used is to assume that the property can be operated at a certain yearly output, and can maintain this output for a fixed term of years at an average profit per ton extending throughout the whole period, and not providing for any increase in output beyond what may be already in sight. The capitalized value of such yearly earnings is taken as the appraised value of the property.

5. In recent years it has become common to base the value upon the actual net earnings, allowing for such reasonable increase as the conditions of the trade indicate may be expected within one or two years, and for which improvements and plans have been projected and provided, treating the proposition from a business standpoint as a going and growing business, which fairly should be worth the price which the earnings justify, provided it be not grossly in excess of the appraised value of the land, plant and improvements, as reached by other methods.

The first method may be dismissed without serious consideration, because it is impossible to determine what would constitute a reasonable profit to the operator developing a tract of land, and, further, because this method ignores the value of the business that the operator has established and the enhancement of land-values due to the development of the property.

The second method is discarded for similar reasons. also because it fails to recognize the fact that the price paid for coal property is a measure only of the value placed upon it by the vendor, who, if not in a position to operate it, may be willing to part with it for much less than its real value. In buying from original owners, coal operators rarely pay full prices, but almost invariably what they believe to be a small fractional part of the real value.

(To be continued.)

Associated Silver Lead Mines of B.C.

The annual general meeting of the Associated Silver Lead Mines of British Columbia was held at Sandon, B.C., on Tuesday, 16th August. The meeting was attended by nearly all the large lead producers of the province.

Officers were elected as follows for the ensuing year:—President, Alfred C. Garde; vice-presidents, James Cronin, W. S. Drewry, W. S. Jenkins, William Hunter and George Alexander; executive committee, Messrs. John L. Retallack, Geo. D. Potter, Norman Carmichael, Louis Pratt, W. E. Zwickey, H. Giegerich and N. J. Cavanaugh; treasurer, Oscar V. White; secretary, N. J. Cavanaugh.

Mr. Garde made a report of what the Association had accomplished during the year then ended. He alluded to the revival of the lead mining industry and to the present cordiality existing between the miners and smelters. The help which the Dominion Government had extended towards the mining of zinc was noted, and congratulations were due the Associated Silver Lead Mines of British Columbia for the results which their efforts had brought about. A resolution thanking the Dominion Government for the legislation granted was unanimously passed.

The Association has been in existence a little over a year, and has been fairly successful in its work. Four new members were introduced at the meeting.

CHEMICAL NOTES.

On account of the reported discoveries of tin in the Yukon Country and in Ontario, we deem it of importance that the following paper by J. H. Collins, which was read before the London Institution of Mining and Metallurgy on the 19th of May should be republished. The importance of finding a new source of tin is recognized in the metal world, and the Review has the hope that the publication of what is known respecting this metal will be of service to prospectors and engineers:

THE SOLUBILITY OF CASSITERITE.

For practical purposes on the mine there is no method of assay known which is likely to supersede vanning ; for, although the weight of 'black tin' obtained from a given sample by different operators may vary considerably, the actual quantity of contained metal will be, in skilful hands, very nearly the same.* For scientific estimations the old Ecole des Mines method of reducing by fusion with KCy and weighing as metallic tin is easy and accurate.†

In the assay of "black tin" by the direct fusion method a previous cleansing by boiling with acid is often recommended, the supposition being that cassiterite is altogether insoluble under such treatment. This, however, is by no means the case ; in fact I long ago noticed that some varieties of natural peroxide of tin were very freely soluble in HCl when in a fine state of division, and that even when HNO_3 had been added to the HCl, some tin was apt to go into and remain in solution for a considerable time.

Early in the year 1903 a very distinguished metallurgist wrote me from the United States to the following effect:—

> "You will probably be surprised to learn that native oxide of tin may be dissolved completely in dilute H_2SO_4 in presence of zinc. I presume it is the nascent hydrogen which does the work, but if anyone had suggested to me the possibility of such a method being applicable to native tin oxide, I should have used 'strong language'; but we 'live and learn.'

Remembering my previous experience of the solubility of cassiterite, I believe I mentioned this remarkable statement of my metallurgical friend to some members of this Institution before making any further experiments, but lately I have made a few tests, the results of which seem to me to be decidedly interesting. I began by taking half a grm. of five different substances‡ in fine powder, reducing them by KCy in a porcelain crucible, dissolving the fusion in hot HCl, precipitating by H_2S, igniting the precipitate, and weighing as $Sn\ O_2$.

No. 1 was found to contain 99.2 of peroxide of tin ; No. 2, 94.0 per cent.; No. 3, 68.0 per cent.; No. 4, 76.0 per cent., and No. 5, 94.5 per cent.

Half a grm. of each sample, in very fine powder, was then placed in a beaker with 20 cc. of dilute H_2SO_4 (1 to 5), and 2 grms. of pure zinc, and left over night. The solutions thus obtained were boiled, precipitated with H_2S, the precipitates collected, ignited and weighed, giving quantities of $Sn\ O_2$, as under:—

No. 1 gave 3 mg.—0.6 per cent. of soluble (out of 99.2 per cent.)
No. 2 gave 9 mg.—1.8 per cent. (out of 94.0 per cent.)
No. 3 gave 160 mg.—32.0 per cent (out of 68.0 per cent.)
No. 4 gave 360 mg.—72.0 per cent. (out of 76.0 per cent.)
No. 5 gave 81 mg.—16.2 per cent. (out of 94.5 per cent.)

Similar treatment with dilute HCl gave very similar results.

From these experiments is is pretty clear that it is the wood-tin varieties which are in any important degree soluble. I have not yet come across any sample which is entirely soluble under the conditions named, but No. 4 comes very near to being so.

I do not pretend that these experiments are in any way complete or decisive, but they are at any rate suggestive, and I bring them before the Institution in the hope that some member who has a laboratory will follow up the subject in a more thorough way than I can find time or opportunity for at present."

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*See remarks by the author in the discussion of Mr. Mackenzie's paper "Trans. Inst. Min. Met.," (vol. xiii), and also experiments reported by Mr. Richard Pearce ("Eng. and Min. Journal," p. 117, Jan. 21, 1904.)

† If lead, bismuth, arsenic, antimony, tungsten or other bases of group 2 are present, proper means must. of course, be taken for their elimination before or after the reduction, but many samples of black tin are obviously free from these bases, and may, therefore, be thus assayed direct. If such silica is present the tin will not readily form one globule. In such cases the whole fusion should be dissolved in hot HCl, and the tin precipitated by H_2S, when the sulphide may be calcined, or reduced before weighing, in the ordinary way.

‡ No. 1 consisted of cheap light-coloured crystals of cassiterite from Great Wheal Fortune, in Breage.

No. 2 closely dressed "black tin," of a fine brown colour, from Wheal Metal, in Breage.

No. 3, reddish-brown wood-tin from Mexico.

No. 4, greyish-brown wood-tin from Bolivia.

No. 5, a dark brown mixture of wood-tin and cassiterite crystals from Wheal Metal.

BOOK NOTICES.

The initial issue of a new mining monthly, the "Mining Magazine," has come to our table, and promises to hold an important position in the field of technical journalism. The form chosen by the management for the issue is that of an octavo of about 90 pages, which we commend for a publication containing articles of permanent merit. That the "Mining Magazine" has such articles is demonstrated by the contents of this first number, in which the well-known and authoritative names of Prof. John A. Church, Fred. L. Ransome, Carl Heinrich and Walter Renton Ingalls are appended to four leading articles.

Prof. Church's brief resumé of mining is a thought-provoking article, in which the older mining engineer will find much food for reflection. The Review is particularly struck by Prof. Church's optimistic view of the future of gold dredging, which voices the opinion ourselves have held for some few years. Mr. Ransome's sketch of the geographical distribution of metals in the United States is valuable, and will be used for reference by many readers, even though it reminds one of S. F. Emmons' contributions to the Transactions of the American Institute of Mining Engineers.

Mr. Ingalls and Mr. Heinrich are both authorities on the topics of which they write, and Mr. Fleming's article on coal markets is exceedingly interesting reading.

In the editorial introduction promise is made of "carefully digested" information taken from current literature, and also an index to such literature. We trust it may be possible to carry out this promise without duplicating the similar work, excellently well done, which is offered in the pages of the "Engineering Magazine."

If the Review may suggest, it will advise not re-duplicating other periodicals' work, but the continuation of presenting original articles so well begun in this number.

"The Baraboo Iron-bearing District of Wisconsin" is the title of Bulletin No. XIII., recently issued by the Geological and Natural History Survey. This monograph has been prepared by Dr. Samuel Weidman, Geologist to the Survey, and contains 171 pp. of text, with 23 plates, numerous wood cuts and several maps. The volume is sent, on application to the Director of the Survey, Madison, Wisconsin, for the remarkably low price of 10c unbound, and 20c in cloth binding.

The Baraboo district is near the centre of the lower or southern half of Wisconsin, and occupies a portion of the two counties of Sauk and Columbia. Its locus is approximately 89 degrees 30 seconds to 90 degrees west longitude and 40 degrees 30 seconds north latitude.

The area covered by this district is about 225 square miles, which is traversed by two ranges that, starting from a common point on the east, diverge towards the west, and have a length of upwards of 25 miles.

The ore, which is mainly red hematite, occurs in the Freedom formation, which consists of two members, the upper being a dolomitic marble and the lower a quartzose rock, carrying the hematite. Analyses show an iron content varying from 52.50 per cent. to 68.80 per cent. with low phosphorous, .010 per cent. to .050 per cent. The Freedom formation is classified as Pre-Cambrian Sedimentary.

PERSONALS.

During this month a group of distinguished geologists have been in a field which is covered by the International boundary line between Minnesota and Canadian territory. The gentlemen composing the group are making a tour through Ironwood, Duluth, Hibbing, the Mesabi Iron Range, the Biwabik Iron Range, the Rainy River and Rainy Lake, the Lake of the Woods, Port Arthur and the north shore of Lake Huron, for the purpose of correcting and correlating the maps issued by the respective geological surveys of the United States and Canada.

The gentlemen in the party are:—Prof. C. R. Van Hise, President of Wisconsin University and a member of the U.S. Geological Survey; Prof. C. K. Leith, of Wisconsin University; Dr. C. Willard Hayes, U.S. Geological Survey; Dr. A. C. Lane, State Geologist of Michigan; Dr. Robert Bell, Deputy Director of the Canadian Geological Survey; Dr. F. D. Adams, of McGill University, Montreal; and Prof. W. R. Miller, Provincial Geologist of Ontario.

John Moore, the foreman of Johnson's Company, Ltd., was badly crushed at Thetford, Que., in an accident which occurred on Tuesday the 23rd of August. Mr. Moore was riding in a car containing crude asbestos, and was caught between a door post and the side of the car, sustaining internal injuries, which, it is feared, may prove fatal.

Mr. Anthony J. MacMillan, managing director of the Le Roi Mining Company, Ltd., passed through Montreal about the middle of the month on his way west.

It is stated that Sir Percy Girouard, late Commissioner of Railways in the Transvaal and Orange River Colony, may be asked by the Dominion Government to take charge of the Moncton-Winnipeg section of the Grand Trunk Pacific.

Mr. John Ashworth, of Ashworth & Morris, mining engineers, of Manchester, England, sailed from Montreal for England on the Tunisian, August 26th. Mr. Ashworth came to Canada some two months ago as an expert witness for the Crow's Nest Pass Coal Company, Ltd., in the suits for damage which were brought against that company in consequence of the memorable explosion which occurred at the No. 2 mine, Fernie, B.C. Mr. Ashworth is an expert on coal gas explosions and safety lamps.

Mining Share Market.

The Canadian market for mining stocks has been in a lethargic state for some little time past, and prices for most securities are merely nominal. Now and again a buying demand arises for some stock, on a favorable report, but the market is so bare that even an advance of the bid price brings out no stock, and the reason is not far to seek. Prices have gone down to such a low level that most holders have locked up their certificates, and prefer to hold rather than accept a few cents for what perhaps cost dollars.

The fact that many securities are intrinsically worth more now than two years ago makes no difference; the public is not interested in mining stocks, and will not venture. The outcome (as of all stock speculations) is problematical, but to those acquainted with the position of affairs in British Columbia the situation is very hopeful, and, as far as can be predicted, it only requires some profit to investors in the shape of dividends to again attract attention to mining investment.

Should any of the leading mines now working at a profit pay anything to their shareholders this year, no doubt people will become interested, but at present the entire absence of public news creates the impression that our mining industry is a thing of the past.

Apart from speculation, properties are being quietly absorbed by those who have some knowledge of values ; mining has got down to a business basis, the newspaper boom is over, and the prospect for a

steady increase in the output of the mines is good. This is the foundation of success. Stocks can hardly go lower than at present, and, taking the record of history, they should steadily advance until another era of speculation carries them beyond intrinsic value.

The following list shows the quotations (bid and asked) which have been made during the month ended Saturday, August 27th, as supplied to the Review by **Robert Meredith & Co.** 57 St. Francois Xavier Street, Montreal.

	Asked.	Bid.
Canadian Gold Field Syndicate.....	.04½	.03½
Cariboo Hydraulic	.75	
Centre Star	.25½	.24
Deer Trail Cons.	.02	
Giant	.03½	.01
Granby Consolidated	3.12	3.00
Montreal and Boston	.75	.60
North Star	.02	
Novelty	.05	.01½
Payne	.03½	.03
Rambler-Caribou	18½	.17
Republic	.03½	
St. Eugene	.45	.35
War Eagle	.12	.11
White Bear	.04½	.03½

The above are the only shares which have been dealt with during the month. The volume of business has been so light that the above record of prices is but a reflection of the indifference with which Eastern Canada is viewing mining investments at present.

MINING NOTES.

NOVA SCOTIA

The St. John "Sun" reports that a topographical survey is being made of the property of the Maritime Copper and Reduction Company. The ore is stated to be of good quality, but the method of working the property will be decided upon by Col. Alperson, whose arrival was expected at the time of the report.

The July output of the Dominion Coal Company was 259,355 tons, obtained from the following pits:—

Dominion	No. 1	33,704
"	No. 2	47,273
"	No. 3	30,845
Caledonia	(No. 4).....	43,816
Reserve	(No. 5).....	65,517
Hub	(No. 7).....	17,117
International	(No. 8).....	21,083
Output	.....	259,355 tons

The total shipments for the month were 294,272 tons.

The Dominion Steel Company, which has only a portion of its plant now running, is making profits in excess of the amount required to pay fixed charges. The Company is equipping its plant for the rolling of rails of heavy sections, and the first rails turned out will be standard 80-lb. rails. The bounty and the extra duty to be imposed under Mr. Fielding's dumping clause will give this company almost a monopoly of the production of steel rails, at a large profit, the Soo works not receiving as large a bounty sum on account of the large use of foreign ore.

The Dominion Tar & Chemical Company, a subsidiary of the Dominion Coal Company, are considering the erection of a creosoting plant to treat timber in Cape Breton. Creosoted timber has been proved to be fully as durable as kyanized timber, which is timber treated with a salt of zinc.

The Cape Breton Electric Company are now operating the street railway line in Sydney and North Sydney, and are furnishing the electric light for both towns. This Company also operates the inter-urban lines from Sydney through the various collieries out to Glace Bay.

The Intercolonial Coal Co., at Westville, N.S., have been the pioneers in Canada of the firebrick industry. The first kiln was burned and discharged this month, and it is believed that the product will prove very satisfactory.

McNeil Bros., of New Glasgow, N.S., have asked for an exemption from taxation for a term of years, and for a bonus of $5,000 in cash, for the iron working plant which they propose to build in Port Hawkesbury, at a cost of about $35,000.

The Dominion Antimony Company has been getting some very beautiful ore in the bottom levels; this ore, which is mostly stibnite, with a little quartz through it, shows gold freely, and it looks very pretty on the black background. Recent shipments have produced returns varying from 40 to 45 per cent. of antimony and from $50 to $56 in gold. It is interesting to note that prior to Mr. McNeil's ownership of the property no gold was ever paid for by the smelters. If the ore shipped in the past contained an equal amount of gold to that shipped recently, nearly $150,000 has been lost to the province through ignorance on the part of the shippers. We should say that the recent shipments contained none of the ore showing free gold.

ONTARIO.

S. Dillon Mills, mining expert, of Toronto, in a letter respecting pyrite smelting, says that where fuel oil can be had at reasonable cost it furnishes a convenient means of experimenting on the amount of extraneous fuel required with different varieties of ore, but also safeguards against chilling. The supply of oil can be adjusted so as to furnish either a reducing or oxydising flame, and any irregularity in the working of the furnace can be regulated as soon as perceived, instead of having to wait the working down of the extra fuel with the stock from the furnace top. He gives an instance when, on one occasion, with three-fourths of a barrel of oil the furnace was prevented from freezing solid.

A company has been incorporated in Ontario, with a capital of $2,000,000, and to be known as the Canadian Iron Company, Limited, for the purpose of developing the deposits of Bessemer iron, which exist at Loon Lake, in the Township of McTavish, north of Lake Superior. Some years ago these deposits were examined in the interest of certain United States capitalists, and turned down. Recent tests with the diamond drill have convinced the company that they are valuable, and as they are only 15 miles from Lake Superior, shipment will be easy. The company is considering the establishment of a smelting plant at Port Arthur. Though the incorporators are all Toronto men, it is understood that the people chiefly interested live in Ottawa, where the head office of the company is to be. Tests with the diamond drill on another property are being made by a company in which Alex. Gunn and others, of Kingston, are interested. R. McConnell, of Ottawa, R. H. Flaherty and Wiley Brothers, of Port Arthur, are interested in iron properties there.

The Dominion Government is fairly committed to the French River and Ottawa Canal scheme, and Sir Wilfrid Laurier has declared that it must be a public work. The supplementary estimates contain an appropriation of $250,000 for surveys of the route. The opening up of this line of communication will be of vast importance to the mining interests of Northern Ontario, affording ready egress and ingress to a large mining territory for the development of which cheap transportation is of the first importance.

W. G. Miller, provincial geologist, is making an examination of the district along the Temiscamingue and Northern Ontario Railway, in which valuable deposits of cobalt were found last year, with a view of finding out how far these deposits extend. He reports several new discoveries, and, though the veins are not large, there is a considerable quantity of mineral in the aggregate.

J. M. Bell, who was sent up to Michipicoten to look for extensions of the iron ranges, reports that he has followed a chain of lakes between Missinabi Station and Magpie River, hitherto unknown. He found three areas of iron bearing rocks. One, on the McDougall claim, 14 miles north of Pascaswa, has a wide band of somewhat impure magnetite running through hornblende schists, the ore body being 400 by 350 feet. Another on the same river is similar in appearance. It is expected that Mr. Bell's investigations will show the iron deposits in that district are more extensive than was hitherto known.

The old reduction works at Keewatin have been sold, and the water power will be utilized for a large flour mill. The stamps will be removed to another property belonging to the same company, namely, the Ottawa Milling and Reduction Company. The water power is considered one of the best on the continent.

Though mining operations in North-Western Ontario are, generally speaking, rather dull at present, there is considerable activity in gold mining. In the Lake of the Woods region the Sultana has 20 stamps working. The shaft is down 700 feet, and is producing a high grade ore. Pellew Harvey, an expert assayer, formerly of Vancouver, has been at the Gold Rock mine, Manitobu, and as a result of his investigations the company has authorized the expenditure of a large sum in development. The Camp Bay Mining Company and the Traverse City Gold Reef Company are both active; the latter is sending its ore to the reduction works at Rat Portage. The Foley Mine, in the neighborhood of Fort Francis, is to be re-opened; an investigation by President Bowden and the Secretary has satisfied them that the ore will pay, and the shaft is to be pumped out. James V. Welch has commenced operations on the New Ontario gold mine, Fort Francis. The discovery of gold near Webbwood last year has given quite an impetus to operations in that district.

Supplementary letters patent have been granted to the Elgin Field Oil and Gas Developing Company, Ltd., of Dutton, Ont., authorizing an increase of its capital stock from $49,000 to $200,000.

The Atikokan Iron Co., Ltd., has been authorized to increase the number of its directors from three to five.

The New York and Ontario Gold Mining Co., Ltd., has increased the number of its directors from five to eleven, and has provided for the holding of special meetings of both shareholders and directors in the City of New York.

An unfortunate affair recently occurred at the Craigmont mine. Wm. Welch, an employee who had gone to make some repairs to the gasolene launch, was attacked by eight Swedish miners armed with knives and a hatchet, and seriously injured. His assailants were arrested, and so popular was Welch that the Swedes were with difficulty saved from being lynched. A report was circulated that Welch had died from his injuries, but this was unfounded, and he had the pleasure of reading a number of highly eulogistic obituaries of himself.

The Pittsburg Coal Company has selected a site and secured 35 acres of land for its coal handling plant at Fort William. It is on what is known as No. 2 Island, and has a frontage on both the Kaministiquia and McKellar rivers. There will be storage for 1,000,000 tons, as this is a great distributing centre for coal. There will be a bridge to the Fort William side of the river.

Contracts have been let for a portion of the branch line of the Canadian Pacific Railway between Toronto and Sudbury, and the construction of the whole line is to be proceded with at once. McKenzie & Mann will, they announce, also proceed with the James Bay road. The construction of these railways is of the greatest importance to the mining interests of Northern Ontario. When it is remembered that the

Sudbury district contributed in freights last year to the C.P.R. the large sum of $1,600,000, the importance of having competing lines as well as new lines opening up mineral regions yet untouched must be evident. The present rush in railway building is said to be due largely to a desire to secure freights from the Hutton iron range.

The Corundum Refineries, Limited, has determined to erect a mill at Palmer Rapids, with a capacity of 100 tons a day. The company has secured 1,360 acres of corundum-bearing lands in the county of Renfrew, and expects to have their product on the market by next spring. Engineers are now at work developing. J. N. Scatcherd, of Buffalo, is president.

The Leamington Oil Company has struck oil in the No. 8 well, which has proved a veritable gusher. The oil, when the vein was struck, spurted over a 72 foot derrick. It flowed 125 barrels the first 12 hours. It is the best well yet struck in the district.

A good deal of development work is being carried on this season in a quiet way about North Bay in gold and copper ores, and some valuable deposits of iron are being opened up. Foley & Co. report a valuable discovery of hematite about 35 miles from North Bay. With a better market for copper, more active operations are expected next year.

Foley & Co., of North Bay, are developing a promising nickel deposit in the Sudbury district. It was discovered about a year ago in what is known as the Northern Nickel Range, and is only two miles distant from the main line of the Canadian Pacific Railway. Assays run from 1 to 7½ per cent., and give an average all through of about 4 per cent.

BRITISH COLUMBIA.

The Boundary mines give the following returns for the first six months of 1904:—

Total output from shipping returns	416,199 tons.
Output for June	68,076 tons.
Value of six months' output, on estimated basis of $5 per ton	$2,000,000

As the Granby Smelter was shut down several weeks, and as the Boundary Falls Smelter, which has been idle for six months, is about to be blown in, the total for the year 1904 is expected to reach 1,000,000 tons for the Boundary mines.

The Great Northern Railway's V.V. & E. branch is likely to be carrying ore out of the Phoenix Camp before many months, which will also help to increase the output.

Concentration is the watchword in the Rossland Camp this year. A year ago there were no concentrators. Now Le Roi No. 2 has a 50 ton plant operating; War Eagle and Centre Star Companies have a 200 ton plant partly running, and in course of completion; White Bear Consolidated has a 70 ton plant partly completed; the Velvet Mine has a 50 ton plant nearly complete; Le Roi has a 20 ton experimental plant working. Following out their experiments in concentration, the Le Roi directorate has had F. W. Bradley, consulting engineer with John McKenzie, make a report on the proposition, and his recommendation is the erection of a 250 ton concentrator, and the increase of the capacity of the mine to 500 tons per day, shipping 250 tons and treating 250 at the proposed concentrator.

The operations of the Western Fuel Company, which owns the coal mines formerly worked at Nanaimo by the New Vancouver Coal Co., are to be very extensive, according to the plans of John L. Howard, of San Francisco, president of the owning company. Mr. Thomas L. Stockett, formerly with the Crow's Nest Pass Coal Company, has taken charge of the mines. At the present time the company is rebuilding the plant at the pithead which was burnt a few months ago. The new installation is to be the most extensive and complete plant for handling coal yet erected in British Columbia. From the mine to the hold of the colliery every step is to be automatic. While the new buildings are in process of erection the company is raising coal through the Protection Island shaft, which has been idle for some years. This shaft is on a small island in Nanaimo Harbor, and the workings are continuous under the harbor between the Protection Island shaft and the main shaft. The company is also developing a new property at Departure Bay, some five miles from the Nanaimo mine. President John L. Howard is credited with the statement that the Western Fuel Company, which is now raising about 22,000 tons of coal per month, expects to increase the output very soon, exceeding the former monthly tonnage of Nanaimo, which used to average 35,000 tons, and making it about 50,000 tons.

Lenora mine matters, which occupied some attention a few months ago in Victoria, where the stock is chiefly owned, appear to be at a standstill. The proposition that English capital should purchase the mine, together with a saw-mill and other holdings, has not been acceptable to all concerned.

Atlin, B.C., modest as its pretensions have always been in the placer mining world, is this season continuing to keep up its average; in a conservative way the camp is turning out a very remunerative return to practically all operators, even the big dredge installed by the British-American Dredging Company last year having satisfactory results.

A big nugget of gold, of which Atlin has yielded several from time to time, was found by Gus Anderson, a miner on No. 2 below Discovery a few days ago. While not so large as the Lambert nugget (valued at $667), this new one is worth $350. Anderson had not reached bed-rock.

A large body of self-fluxing sulphide ore has been opened on the McKinley claim, Franklyn Camp, East Fork of North Fork of Kettle River, 50 miles from Grand Forks in the Boundary District.

In a small way, the most successful mining operations on the coast have been carried on by the Marble Bay Mining Company at Van Anda. The Tacoma Steel Company, through Hy. Hewett, has since February, 1902, paid over $110,000 of the purchase price of $150,000 to J. J. Palmer, the former owner, every dollar of the money being taken out of the mine. The mine is copper, gold and silver, and the mineral is deposited in cones. Its success has been due largely to good management. A depth of 560 feet has been attained, which is a mere hole in the ground beside the Montana mines. The Golden Slipper, on the western portion of the island, owned by C. R. Miller, has been sold to Seattle parties for a good price. This is a developed prospect, the mineral is rich and the mine very promising.

B. C. Riblet, of Spokane, has left for the Britannia mines, Howe Sound, where he is installing a three-mile tramway at a contract price of $72,000. He says the work will be carried on as rapidly as possible, and he expects to see it finished by the end of the year. It is the intention of the company to make the Britannia one of the biggest producers in the province. More than half a million dollars will, however, have been expended before that stage is reached. The working capacity of the tramway will be one hundred tons per hour. It is the intention to erect a concentrator at the coast end of the tramway, and to ship the concentrates across to the smelter at Crofton.

The smelters of Trail are daily handling 600 tons of gold-copper ore and 100 tons of silver-lead ore and concentrates, while the refinery turns out 11 tons of lead daily. How different a few years ago. Not a single ton of lead ore was smelted in this province seven years ago. Now not a ton is shipped out for that purpose. Ten years ago not a ton of copper ore was smelted in British Columbia. Last year 1,000,000 tons were mined and reduced by the smelters of Trail alone. Recently Mr. G. O. Buchanan, Administrator of the Dominion lead bounty, was at Nelson. He declared that up to June, the end of the fiscal year, $183,000 had been earned by the lead-producers. Of this $109,800 has already been paid out, and the balance of 40 per cent., or $73,200, will be paid as soon as it is shown that the lead ore claimed for has been treated in Canadian smelters. The output of ore tonnage of what are known as the Boundary mines alone for the first six months of this year totals 416,023 tons, or nearly 70,000 tons a month, and it is likely to reach a round million for the year.

These smelters have an interesting history. The plant was started by Mr. F. A. Heinze nine years ago, but, as is well known, the C.P.R. made them what they are, securing control in 1898, and now operating the plant under the name of the Canadian Smelting Works.

According to Government reports the mineral products of British Columbia for the census year 1901 reached the value of $14,679,700, or over $4,000,000 greater than any other province in the Dominion, and nearly $5,000,000 greater than the Territories, which include the Yukon. It has been proportionately greater every year. This will give some idea of her vast mineral wealth and activity. This July has been a record-breaking month even for Trail. Not only have the Canadian Smelting Works inaugurated a new industry in Canada by manufacturing the completed lead product at an estimated cost for new plant of $100,000, but the biggest shipment of Canadian refined silver in the history of the country has been made this month. The shipment consists of 70,000 ounces, and is worth over $40,000. It goes to China.

All the Kootenay papers report extensive forest fires. It is reported that in the vicinity of Fernie two million feet of logs have been destroyed. The damage is not confined to East Kootenay, but fires are also reported from the Slocan and the neighborhood of Kootenay Lake.

YUKON.

Mr. William Ogilvie's dredging company, the Ogilvie Dredging Company, operating on the Stewart River, is said to be saving $100 per day in gold from a bar near Clear Creek, a tributary of the Stewart. The cost of operating is said to be $50 per day. Mr. Ogilvie, whose son Morley has been north for some months at the dredge, was in Vancouver a week ago on his way from Dawson.

Dawson returns of gold for the Yukon for the period ending June 30th of this year total $3,866,317.85, exceeding last year's returns for the same period, which were $3,718,965.10.

There have been some returns from the new Alsek placers near White Horse, which would indicate that, though the season is early yet, very fair returns in gold will be realized. K. B. McLennan, a well-known Vancouver man, recently brought into White Horse from the creeks a hundred ounces of gold saved in a very short time from claims on Bullion Creek.

The "Yukon World," of Dawson, Y.T., under date 13th July, 1904, prints an account of the Alsek District from information received from Mining Inspector Burwash. The country embraced in this new district covers an area 50 by 150 miles. From Whitehorse (on the Yukon) it is 275 miles to Arch Creek over a very difficult trail, which reaches a height at one point estimated at 10,000 feet, and crosses extensive snowfields. The gold found is very coarse, scarcely a particle running less than a grain in weight. In Mr. Burwash's words, as quoted by the paper:—It is essentially a poor man's district, as, with the exception of a very few localities, the ground is all shallow, with not a particle of muck to be seen, gravel reaching from the surface to bedrock, and averages from two to six feet deep. In one or two places it has been found to be fourteen feet to bedrock with gravel all the way

COAL NOTES.

Vessel owners expect a heavy coal traffic on the lakes this fall, and at rates that will make up for the losses due to the strike idleness this spring.

The Dominion Coal Co.'s output for July was 259,355 tons, compared with 331,090 tons in June. For the seven months to August 1st the production was 1,765,136 tons, as against 1,893,128 tons for the same period in 1903.

F. L. Wanklyn, vice-president of the Dominion Coal Co., is quoted as saying that within two years his company will be delivering between 1,500,000 and 2,000,000 tons of coal at Montreal, as against 1,000,000 tons or a little less during the season of 1904. This great increase in tonnage will be brought about by increased shipping facilities, including new and larger steamships, steel coal towers of about double the capacity of those now in use, additional docks, etc.

An official of the Dominion Coal Co. states that the recent acquisition by the Nova Scotia Steel & Coal Co. of extensive submarine coal areas in Cape Breton will in no way affect the future operations of his company. The submarine areas owned by the Dominion Coal Co. are some 17 miles in length, and have an average width of three miles, so that the coal resources of the company are practically unlimited.

James Ross, President of the Dominion Coal Co., states that during July his company shipped 60,000 tons more up the St. Lawrence River than in any other month since shipments were begun, and that the large tonnage in that direction will be maintained until the end of the season. The closing of some of the shafts was due to the strike at the plants of the Dominion Iron & Steel Co. and the consequent restriction of the fuel requirements of the company.

The mines at Coal Creek, B.C., are in operation most of the time, although compelled to suspend occasionally because of lack of cars. Some days the output runs as high as 1,800 tons, with the mines working on single shift.

At the annual meeting of the British Columbia Collieries Co., held at Victoria, B.C., G. W. Lovell was re-elected president. The company has secured large grants of Government land in the Similkameen district of British Columbia, which is very rich in coal and easy of development as soon as the region is made accessible by a railroad.

The extensive operations of the Canadian Pacific Railway Company's mining department in developing anthracite coal measures at the foot of Cascade Mountain in the National Park, Banff, deserve more than passing mention. Their extent may be briefly referred to by saying that over 300 men are now engaged at the mines at Bankhead, as it is called, and the work is only preliminary, opening the mine, running tunnels, building shops and mine works, erecting a town of model modern construction for the comfortable housing of the operatives and their families. The intention is to have at least 1,000 employees there in a year's time. The mine will supply to a large extent the needs of Manitoba and the Northwest in hard coal an unlimited market, and coking coal is also found at the same place. The mines are five miles from Banff Station, and a spur line has been run from the main line right to the mines. Mr. W. H. Aldridge, superintendent of all the C.P.R. Company's mining and smelting interests, is directing this new enterprise, and Mr. W. S. Ayres, mining and mechanical engineer, is resident engineer in charge of the construction and other works. It is expected that the mine will ship this year.

The Crow's Nest Pass Coal Company has leased from the C.P.R. the branch line from Fernie to Coal Creek, five miles. This branch was built to carry coal from the company's Coal Creek mines to the Fernie coke ovens. It was the intention of the Coal Company to build a parallel line to Coal Creek and extend to Morrisey to connect with the Great Northern Railway, but the extension is all that will now be built. The Coal Company was represented by Mr. G. G. S. Lindsay, of Toronto, in taking over the line. It will buy its own rolling stock, and commence operating the branch October 1st.

INDUSTRIAL NOTES.

The Canada Foundry Company have closed a contract with the Canadian Northern Railway for a bridge over the North Saskatchewan and northwest of Battleford, at what is known as the Second Crossing. It will consist of eleven spans, and the total length of the steel superstructure will approximately be 1,870 feet, not including the length of the approaches. The total weight of steel entering into the structure of this bridge will be approximately 3,500,000 pounds.

The A. Leschen & Sons Rope Co., of St. Louis, which has evolved from the modest beginning made by Adolph Leschen in 1857, are making very extensive sales. Their huge sky advertisement, visible by night as well as in the day time, is one of the first signs which is noticed by visitors to the World's Fair. This firm has recently reported the results of five and one-half years' continuous work of one of their patent flattened strand ropes, which has been in use on an elevator in St. Louis. After this length of service the original diameter of the rope is reported as having decreased by only 1-64th of an inch, a truly remarkable record.

The Wellman-Seaver-Morgan Company, of Cleveland, Ohio, are now the sole manufacturers of the well-known Sargent gas engine, which is made in any size from 100 h.p. as a minimum upwards. The Sargent engine is a double-acting tandem, and claims to get complete expansion of the burning charge; it also has the great merit of simplicity of mechanism, so that the usual multitude of valves and levers is happily conspicuous by its absence. The recognized standing of the Wellman-Seaver-Morgan Company and its enviable reputation for turning out good work should be a guarantee for users of the Sargent engine.

In June last the business, stock and goodwill of the late James Cooper, Montreal, were acquired by the new firm of F. H. Hopkins & Co., which will continue the business by furnishing railway contractors' and mining supplies.

The new firm have taken spacious offices in the new Imperial Bank Building, 286 St. James Street, Montreal, and have a large warehouse, 17 to 27 Normand Street, where a complete assortment of stock for customers' requirements is kept.

The members of the new firm are Mr. Frank H. Hopkins, for over twenty years associated with Mr. Cooper and the firm of Cooper, Fairman & Co.; Mr. J. J. Rosevear, who was financial manager for James Cooper, and Mr. R. A. C. McNally, who has been in charge of mining machinery in both the far west and the east for many years.

The firm has the agency for the Canadian market of Cammell steel rails, axles and ties; the J. H. Andrew Co.'s tool and dull steel; the Marion Steam Shovel Co.'s dredges, shovels, &c.; the Pittsburg water meter; the Ransome Concrete Mixer; the Dominion Wire Rope Company's ropes, cables, fittings, etc., and many other agencies.

The Dominion Coal Co. have placed an order this month with the Ottumwa Box Car Loader Co. for one of their loading machines. The demand for these labor-saving devices is rapidly increasing, as the coal is loaded with less breakage than in any other manner. A number of these Ottumwa loaders are already in use in the Cape Breton field, and give great satisfaction.

Digest of Recent Patents; Mining and Metallurgical.

UNITED STATES.

July 26, 1904.

765,801.—Ore Washer and Separator. Samuel R. Wise, Whiteoaks, New Mex. An ore washer and separator comprising a longitudinally-inclined box or casing provided with a screen above a riffled bottom, said screen and bottom discharging at their upper ends, adjustable hangers supporting the box at the upper end, means at the lower end, supporting and imparting vertical and horizontal movement to the box, whereby material under treatment is tossed toward the upper end thereof, in combination with a water--distributing pan supported above, and adjustable independently of the box or casing.

765,998.—Ore Roasting Furnace. George H. Shellaberger, Dekalb, Ill., assignor to Apex Manufacturing Company, Kansas City, Mo., an Arizona Corporation. An ore-roasting furnace, the combination of a furnace-body provided with one or more extended ore-chambers, and an air-trunk extending through the length thereof contiguous to said ore-chambers, one or more communicating passages between said air-trunk and ore-chambers, a heat-generating furnace, an air-pipe extending through and heated in the combustion-chamber of said furnace, and communicating with said air-trunk of the furnace-body, and means for supplying air under pressure to said air-pipe.

766,156.—Ore-Roasting and Oxidizing Apparatus. Lyman H. Allen, Kansas City, Mo., assignor by direct and mesne assignments, of four-fifths to Ora A. Johnson, Charles E. Bye and William O. Bye, Kansas City, Mo., and Mary Elizabeth Stewart, Sonora, Cal. An apparatus for reducing ores comprising a rotary ore-retaining cylinder having flame-conducting openings at its forward end; a reducing-furnace, a flame-conducting cylinder leading from the furnace within the opening in said cylinder; means for drawing off the gases from the cylinder, and an open water-receptacle concentric with the inner side of the cylinder, and located at its forward end, adapted for the storage of the liquid to be vaporized, water-pipe leading within the flame-conducting opening of the cylinder and discharging downwardly within the open water-receptacle.

766,060.—Ore-Pulp Washer and Concentrator. Francis E. Parker, Kansas City, M. The combination, with the receptacle, for the concentration of metals from ore-pulp, having valved discharge-openings for the waste material; of suspensory devices for said receptacle, means for communicating an oscillatory movement to said receptacle, and a series of stud-shafts located at the limit of oscillation of said receptacle in pairs; horizontal guide-rollers on said shafts, arms extending radially from the side of said receptacle ,and guide-pins on said arms contacting with said rollers, and controlling the curvilinear movement of said arms, and stationary pulp-agitating devices located above the receptacle and extending downwardly within the same and adapted to loosen the material at the discharge-openings in the receptacle.

Aug. 2, 1904.

766,654.—Method of recovering Values from Ores by dissolving in Molten Baths. Ralph Baggaley, Pittsburg, Pa., and Charles M. Allen, Lolo, Mont.; said Allen assignor to said Baggaley. A method of producing matte, which consists in forming a molten bath of matte, blowing air thereunto, adding ore relatively high in silica, fluxing thereby the iron of the bath, and replenishing the bath with material relatively low in silica, and high in matte-making compounds.

766,279.—Process of Making Spelter. Oskar Nagel, Hamborn, Germany. An improved process for reducing zinc oxide ores, which consists in subjecting the material to the reducing effect of natural gas, the said gas being highly heated previous to entrance in the reducing-chamber, and in cooling the resulting zinc-vapors in an atmosphere of such gas.

766,718.—Ore-Concentrator. Howard E. Marsh, New York, N.Y., assignor by mesne assignments, to Jarvis, Simmons & Company. Incorporated, New York, N.Y., a Corporation. The combination with a drum open at both ends, and having a reduced portion and feeding mechanism upon the drum; of a suction-fan in one of said ends, a magnetic disk in the opposite end of the drum, baffle-plates interposed between said fan and disk, and an outlet between said fan and plates, said outlet being adapted to receive particles from the reduced end of the drum.

766,626.—Gold-Saving Apparatus. Edward S. Kelley, St. Joseph, Mich., assignor of one-half to Willis W. Cooper, Kenosham, Wis., Henry S. Cooper, executor of said Willis W. Cooper, deceased. A gold-saving apparatus in combination with a sluice-bix; a conveyor fitting closely to the inner wall thereof; means for rotating said conveyor to carry earth and water positively and with comparative slowness through said sluice-box, to prevent current in or agitation of the fluid mass; a bottom trough extending longitudinally of said sluice-box; amalgamated partitions in said trough; and a pocket having an inlet-opening near the discharge-opening of said sluice-box, into which inlet-opening gold particles fall by gravitation.

12,254.—Roasting-Furnace. Lewis T. Wright, Keswick, Cal. The combination with a series of floors, of a central hollow shaft, hollow arms carried thereon over the respective floors, an open-bottomed pipe inserted in said shaft, an intermediate pipe in said shaft into which the first pipe discharges, open-ended pipes leading from the intermediate pipe into the hollow arms, and feed and exhaust pipes connected to the first pipe and hollow shaft.

Aug. 9, 1904.

767,179.—Furnace for Melting Metals or other purposes. Carl Spiegel, St. Petersburg, Russia. A melting-furnace, the combination of a fire-plate provided with a naphtha-supply means and with hemispheric projections, said plate being provided with perforations extending through said projections, and upwardly flaring at their upper end, and said projections being on the upper face of the plate, with an air-supply chamber secured to and under said plate and in communication with said perforations.

767,365.—Amalgamator. William E. Vandenburgh, Chicago, Ill. An amalgamator comprising a fixed conduit for the pulp, a mercury-trough in the conduit, spherical bodies revoluble in the mercury in the trough, and rings spaced from and extending around the spheres, also revoluble in the trough, and disposed with relation to the spheres and in planes substantially parallel with the current of the pulp.

767,276.—Dry-Sand Amalgamator. Frederick J. Hoyt, Redlands, Cal. The combination with an amalgamated mercury-floated rotary sphere, of a pipe, and nozzle thereto, to discharge on said sphere, an air-reservoir, an air-compressor and an air-engine, connected to operate.

766,880.—Gas Producer. Jerome R. George, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts. The combination with a heating-chamber provided with an opening in its top for the admission of coal, of a coal-reservoir located above and over said opening, and having an opening in its bottom for the delivery of coal, a rotating coal-distributor between said reservoir and the producer-chamber, said distributor consisting of a hopper-shaped spout with its upper or admission end concentric with its axis of rotation and of greater area than its lower or delivery end, which is eccentric to said axis of rotation, with the inclined side of said hopper-shaped spout at an angle to a vertical plane whereon coal will flow freely by force of gravity alone.

767,105.—Magnetic Separator. Myron Dings, Milwaukee, Wis. The combination of a electromagnet having a substantially vertical axis; a cup-shaped lower pole-piece partially inclosing the magnetic winding; an upper pole-piece covering the magnet and protecting marginally therefrom; a non-magnetic ring of less diameter than the upper pole-piece, but connected to the latter and arranged to cover the upper edge of the lower pole-piece; and a conical distributing shield covering the upper pole-piece except at its marginal edges.

Aug. 16.

767,840.—Regenerative Gas Reheating-Furnace. Frederick Siemens, Dresden, Germany. A regenerative gas reheating-furnace having primary and secondary chambers in communication with each other for the passage of billets, blooms or the like from the primary to the secondary chamber, means whereby a gas-flame is directed across one of said chambers above the bed thereof and between the ends of said bed, said flame being of a gradually-increasing temperature from one end of said bed to the other, and means for heating the other furnace-chamber.

767,926.—Ore-Concentrator. Christoffer A. Christensen, Oretown, Oregon, U.S.A. An ore-concentrator, consisting of a diamond-shaped table having riffles formed across the same, said table provided with a rise or upward incline along one side, and up which the ends of said riffles extend, troughs upon said rise or upward incline provided with lateral outlets facing the lowest portions or bottoms of the riffles, means for supplying water to said troughs, a receiving-trough disposed beneath the upwardly-inclined ends of the riffles a hopper at the upper side of the trough and opposite end from the said rise or upward incline, and means for imparting vibratory jarring motion to the table.

ENGLISH PATENT.

Crucible Furnaces. M. Harvey, Walsall. A portable furnace containing a crucible is fixed in an outer casing, which forms a blast chamber, so that the contents can be poured without removing the crucible. The outer casing is provided with trunnions, and is mounted on a carriage. Means are provided for leading the blast into the furnace, for charging the fuel, for tilting the whole, and a spout for pouring.

NEW COMPANIES.

ONTARIO.

The Alpena Oil and Gas Co., Ltd. Incorporated 27th July, 1904. Capital, $100,000.

The Goderich Cement Brick Co., Ltd. Incorporated 29th July, 1904. Capital, $40,000

The Canadian Cement Brick Co., Ltd., Incorporated 15th June, 1904. Capital, $150,000.

Silver King Gold and Copper Co., Ltd. Incorporated 30th June, 1904. Capital, $2,000,000. Provisional directors:—Harvey Lawson Holmes, William Herain Merrill and George Wellington Morris. Head office: Toronto, Ont.

Canadian Ore Concentration Co., Ltd. Incorporated under the laws of Great Britain. Attorney, Robert Charles Donald, of Toronto.

Dominion Cement Brick Co., Ltd. Capital, $50,0000.

The Empire Salt C., Ltd. Capital, $50,000. Head office, Sarnia, Ont. Provisional Directors :—Jas. J. Carter, Chas. H. Rogers, Jas. H. Kittermaster, David Milne and Alex. S. Burnham.

The Canadian-Michigan Gold Mines, Ltd. Capital, $1,000,000. Head office, Sault Ste. Marie. Provisional Directors :—Wm. Coyne, Chas. A. Brown, of Sault Ste. Marie, Ont.; John B. Spellman, Webbwood ; Elmer S. B. Sutton, Otto Supe, Sault Ste. Marie, Mich., and H. Asmus, Buffalo, N.Y.

The Ontario Crude Oil Co., Ltd. Capital, $300,000. Head office, Toronto. Directors:—John W. Stokes, Sarnia; W. D. Earngey, James Kynoch, A. M. Miller, Erastus Miller, Toronto.

The Silver King Gold and Copper Co., Ltd. Capital, $2,000.000. Head office, Toronto. Directors:—Rev'd H. L. Holmes, W. F. Rugg, Niagara Falls, N.Y.; Wm. H. Merrill, G. W. Morris, Buffalo, N.Y; Howard Denison, Toronto.

BRITISH COLUMBIA.

Flathead Valley Oil Lands Development Co., Ltd. Incorporated 7th July. Capital, $250,000, divided into one million shares of 25 cents each.

Dundee Gold Mine Co., Ltd. Incorporated 25th July, 1904. Capital, $[illegible],000.

The Elk River Coal and Oil Co., Ltd. Incorporated 12th July, 1904. Capital, $25,000.

The Eva Gold Mines Co., Ltd. Incorporated 22nd July, 1904. Capital, $500,000.

Ross & Howard Ironworks Co., Ltd. Incorporated 23rd July, 1904. Capital, $250,000.

The Georgia Rock Co., Ltd. Incorporated 27th June, 1904. Capital, $10,000.

The Green City Mining and Improvement Co., Ltd. Incorporated 26th July, 1904. Capital, $100,000, divided into two hundred shares of $500 each.

Consolidated Spruce Creek Placers Co., Ltd. Head office: Seattle, Wash., U.S.A.; head office in B.C., Victoria; attorney, Frank Weir. Capital, $30,000.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills, who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licences to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly, either by arrangement with the owner or by arbitration, all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

PROVINCE OF QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles and the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mining of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals, and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in surveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds: Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P.Q.

Dominion of Canada.

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within 15 days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permisson may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING.

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be made within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one-half per cent. on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200.

A certificate that work has been done must be obtained each year ; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North-west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior,

Ottawa, February, 1904.

JAMES A. SMART,

Deputy of the Minister of the Interior.

CONTRACTORS TO H. M. GOVERNMENT

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS

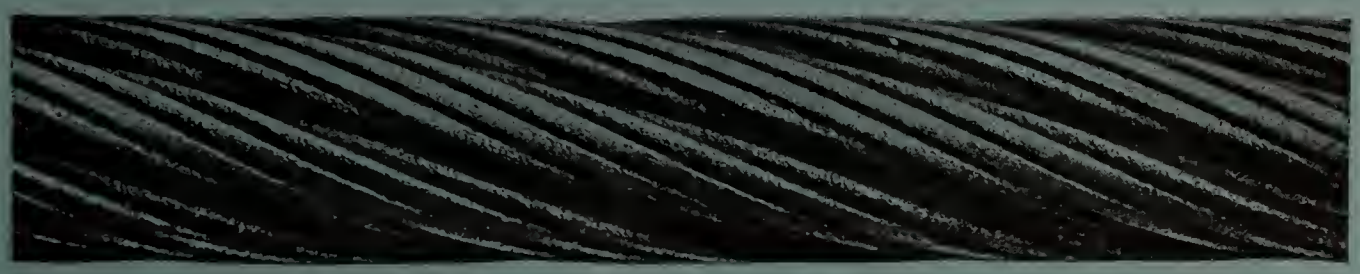
Rutherglen, Glasgow, Scotland

MANUFACTURERS OF

WIRE ROPES for Collieries, Mines, Aerial Tramways

Transmission of Power, Logging and general Hauling and Hoisting Purposes.
Wire specially selected for own exclusive use.
We have made many records with our Winding, Haulage and Crane Ropes.

Illustration of **Winding Rope**, 240 fms. long x 3½ circ. Galvanized Special Improved Patent Steel, Compound Make, supplied



to Kenneil Collieries Bo'ness, Scot., which gave a record life of 6 years and 2 months. Shewing condition when taken off.

TELEGRAMS—"Ropery Rutherglen." A B O, A I and Lieber's Codes used.

AGENTS IN CANADA:

Wm. Stairs, Son & Morrow, Ltd., Halifax, N.S.
W. H. Thorne & Co., Ltd., Saint John, N.B.
Drummond, McCall & Co., Montreal.
John Burns, Vancouver, B.C.

DRUMMOND, McCALL & CO.

IRON, STEEL AND GENERAL METAL MERCHANTS

GENERAL SALES AGENTS

Algoma Steel Co. Ltd., Sault Ste. Marie, Ont.

AND IMPORTERS OF

Beams, Channels, Angles and other Structural Material.
Steel Plates—Tank, Boiler and Firebox Quality.
Cold Rolled Steel Shafting.
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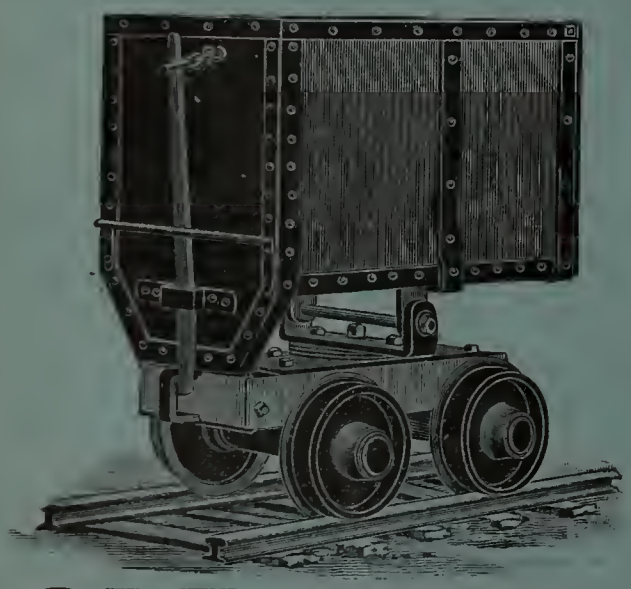

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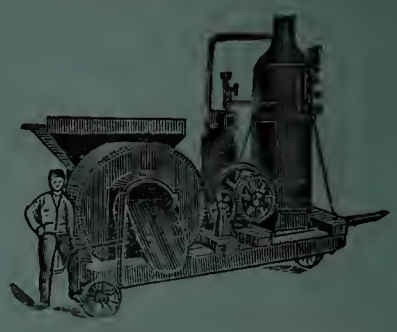

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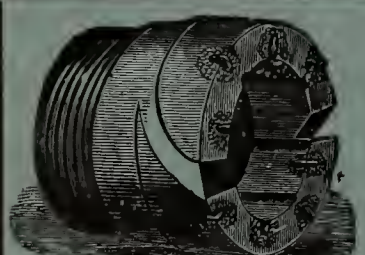

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CONTENTS.

Our article on The Nicola Coal Field in the August issue has occasioned the receipt of two letters from gentlemen interested in corporations operating in that field, who object to the characterization of the coal which our correspondent gave as "of a low bituminous character, just a little removed from lignite."

In support of their objections our correspondents give analyses which support their views that the coal is bituminous. At the same time the REVIEW begs to say that the words it used characterized the coals as *bituminous*, not as *lignitic*. The REVIEW has no wish to depreciate property, nor to misrepresent facts, and has taken steps to have this matter settled in time for publication in our next (October) issue.

While on the subject of coal, we cannot refrain from again impressing upon investors the fact that coal deposits of great magnitude have been discovered in various parts of British Columbia during the last half dozen years. With coal on Vancouver Island, in the Nicola District, at Crow's Nest Pass, at Banff, at Anthracite, at Lethbridge, Canmore, Frank, Coleman, Hosmer, and in the Blairmore, Flathead and Elk Districts, and with every grade known, from lignite to anthracite, there is sure to be a surplus for the comparatively limited market now existent. Supply and demand will settle how many of the score of coal companies now in the field can weather the storm; certainly there is no present market for all the coal these companies can send out.

The many improvements which have been made in connection with gold-dredging machinery are attracting much capital to this most successful branch of gold mining. The centrifugal elevator, or refuse ejector, of Messrs. Payne and Peck, and the silt-distributor of McGeorge, are two of the most important new inventions. In view of the fact that some 50,000 acres of good arable bottom lands and orchard country are being yearly destroyed on the North American continent, the invention of McGeorge is likely to be of permanent value. Essentially the apparatus is intended to distribute soil on top of the rocks and boulders left by the dredge so as to re-make arable land. So far the tests made have shown that grass, grain and young trees planted on the new ground have thriven and done well. If further results continue to be satisfactory, the hue and cry of the low land farmers will be effectually silenced.

A piece of news which Eastern shareholders profess no knowledge of is that the dredge of the Ogilvie Gold Dredging Co. has left its rich (?) bar on the Stewart River and gone into contract work on the Klondike River, about half a mile above the bridge; Dawson papers of the 26th of August report the dredge to have been at work on that date. Outsiders (and perhaps some shareholders) might be curious as to why a dredge, built to save gold on a concession extending over more than 80 miles, should have been diverted to a 50 per cent. tribute lay on another concession some 150 miles distant. But if such outsiders were shareholders in the Ogilvie Co. they probably would receive the declaration that their president was omniscient, and not to be annoyed by vulgar questions.

There are divergent rumors as to the results which have been obtained this season on the Stewart River ; one set of rumors declares the work to have been unremunerative, another set predicts the payment of a handsome dividend in December. If results have been such as to justify a dividend, it seems difficult to understand why the dredge should have been put to work on another concession. The Williams concession, on which the dredge is now working, is reported to contain a large amount of pay dirt.

Lead in Ontario.

A small disturbance among the British Columbia producers of lead ores has been occasioned by the request made to the Department of Trade and Commerce by the owners of the small lead furnace at Bannockburn, Ont. These gentlemen, having smelted a quantity of ore and produced several tons of lead bullion (about 25 tons), desired the Government to send an official to inspect and verify their product so that they might avail themselves of the provisions of the Lead Bounty Act, and obtain the $15.00 per ton to which they are entitled. But there is not the least occasion for the British Columbia gentlemen to get excited over the possibility of losing their share of Government pap.

The existence of ores of lead in Ontario, Quebec, and Nova Scotia has been known for more than thirty years, and the various and spasmodic attempts which have been made to work these ores are of equally clear knowledge. The deposits in Tudor (of which the Bannockburn is one) occur in calcareous and micaceous schists associated with limestones and dolomites of Silurian age. Some of these deposits occur associated with a gangue of barytes and calc spar, and are small in extent, others are from 18 in. to 24 in. in width, the ore appearing in bunches and as disseminated grains in the gangue. Some larger masses of galena are occasionally found, but the characteristic of the region is a lack of continuity to the deposits.

In both Tudor and Lake Townships there appear to be two distinct sets of deposits, one striking north-west, the other north-east, and where two veins cross each other there is usually an enlargement at the surface which does not continue in depth. There are, in addition, other veins, usually with a quartz gangue, which are somewhat larger, and which cut through the gneisses of Elzevir Township.

The association of arsenical and antimonial ores with the galenas of this section is not infrequent; their values in silver are low, running from 3 to 8 ozs. of silver to the ton of galena, and the majority of samples show no gold whatever.

The REVIEW has no personal knowledge of the Bannockburn mine, but only of the district in general. It sincerely hopes that a lead industry may arise and thrive in Eastern Ontario, but the known and recorded facts are in opposition to such a hope.

Our British Columbia producers will have exhausted the provisions of the Lead Bounty Act before Ontario becomes a formidable rival in the production of lead ores.

The Le Roi Mining Company.

It is not long ago since "Le Roi" was a name to conjure with in mining circles. Just how many successful promotions have been effected on the strength of Le Roi ore, Le Roi profits, and Le Roi share values, will probably never be known, but the veriest tyro in mining knows that their name is legion. No mine of genuine merit has had a more chequered career. To recount the various stages in its downward career, from the date of its sale by the Turner syndicate, would require more space than is at our disposal, and, at the present crisis of its affairs, we are more disposed to "point a moral" than "adorn a tale." In the permanent worth of this property, if completely and honestly handled, we have every confidence, for it could not have survived its many vicissitudes were it not that no amount of misrepresentation and manipulation could obscure the fact that it is a large and profitable property. Passing by the Whittaker Wright "coup" and the assaying error of last winter, we find a recent development of which comparatively little has been said, but which invites close enquiry, both in the interests of the shareholders and of the province.

It was noted, a few months ago, that negotiations were on foot for the amalgamation of the Le Roi, War Eagle and Centre Star properties. On being interviewed, the leading officials of the companies named admitted the fact. Later on reports from London showed that the directors of the Le Roi had the matter under consideration.

A feature of the proposed combination, which was of still greater importance, was the contemplated erection, or purchase, of a smelter on Canadian soil. This latter feature we do regard as essential to the ultimate success of the Le Roi for reasons which will shortly appear.

The latest information from London is that this proposed merger has fallen through—no explanation is given—and since we have it on the authority of Mr. T. G. Blackstock that the scheme was desirable in the interests of the companies he represents, it must be considered that the failure is due to indifference on the part of the Le Roi corporation. The giving out of this information synchronizes with the return of Mr. A. J. McMillan to this country, and a complete reorganization of the management staff. How far the personnel of the new staff is significant as indicating the future policy of the Le Roi must be left to the public to decide for itself. It demonstrates, however, the control of Mr. McMillan, who will now have a free hand since Messrs. F. W. Bradley and J. H. MacKenzie, the engineers who have recently advised the company, are not retained.

The future policy of the Company may be indicated by the fact that negotiations have been commenced by the Le Roi Company for the purchase of the Snow Shoe Mine in the Boundary. This mine belongs to a London company, of which Mr. Waterlow is the chairman and the largest shareholder.

It is also a matter of common report that the Le Roi Company have recently been purchasing interests in the Pack

Train Claim at Rossland—a property to which little or no importance is attached locally. No doubt the object of this policy is to consolidate the position of the Le Roi by securing other properties containing ore which can advantageously be treated with its own product, but such a selection should be made with the utmost care, and with the sole consideration of Le Roi interests. This raises finally the most important and serious aspect of the question as affecting all parties, viz., that of smelting.

This, after all, is the crux of the question, because it has the most vital influence on the question of profit or loss, and there is no question that the treatment of the Le Roi ores can be more profitably dealt with on the Canadian side, irrespective of any scheme for amalgamation, and irrespective of the acquisition or non-acquisition of other properties to be worked in conjunction with Le Roi. If the present action of the Le Roi directorate is to be regarded as final, we must assume that they are as much in love with their own smelter at Northport as ever, and will continue to operate it for the reduction of Le Roi and any other ores they may produce. This policy was clearly foreshadowed by the chairman of the company at the last annual meeting, when he expatiated at considerable length on the excellence of their smelter and its value as an asset.

It has always been a grievance in British Columbia that Rossland ores should go to Northport for treatment. There can be no question that Northport smelter would never have been built but that, at that time, the Le Roi belonged to Senator Turner, of Spokane, and his associates. It has long since been demonstrated to the satisfaction of everyone, except the Le Roi directorate, that, instead of being "a valuable asset," it is a "white elephant." However great Canadian solicitude for Canadian interests may be, the abandonment of the Northport smelter on patriotic grounds alone could not be advocated, nor could it if the change would involve pecuniary loss, but when such a course would vastly benefit the shareholders of the Le Roi Company, it becomes difficult to understand why a policy should be inaugurated perpetuating a constant loss.

To show that Rossland ores can be, and have been, treated more advantageously at Canadian than American smelters, it is only necessary to point out that the adjoining mine to the Le Roi (Centre Star) during its last financial year, made a net profit of $228,359.00, as per balance sheet published. This was on the sale of 88,387 tons of ore, averaging $10.58 a ton gross assay value. This ore was treated at the Trail smelter, and received an advantageous freight and treatment rate, which enabled the mine, using the Canadian smelter, to obtain actual cash results that compare more than favorably with its bigger neighbor. The Le Roi shipped to its own smelter at Northport 172,669 tons of first class ore of an average gross assay value of $13.36 per ton, and 7,196 tons of second class ore averaging $11.18 per ton, upon the whole of which the estimated profit of $378,421.00 was made, though later developments tend to cast doubt on the accuracy of the estimate. A comparison of these results shows a surplus in favor of the ore treated at the Canadian smelter of $3.00 a ton. Of course this is not all accounted for by cheaper treatment, but, after making every allowance for other items, it is evident that a substantial balance is attributable to that source.

We respectfully submit that the foregoing statements are well worthy the consideration of the directorate and shareholders of the Le Roi Company. The Province of British Columbia has been the graveyard of not a few reputations, both financial and professional. It has been blamed for all the misdeeds of all the unscrupulous promoters and incompetent managers who have exploited its mineral wealth, but if confiding shareholders choose to plunge ahead regardless of the advice and warnings of the mining press and of the men who have the true interests of the province at heart, they must take the consequences, and need not look for sympathy.

The Alaska Gold Belt

The U. S. Geological Survey will shortly publish a bulletin on the Juneau (Alaska) gold belt by Messrs. A. S. Spencer and C. W. Wright. These gentlemen were detailed to make an extensive examination of the schistose country in southeastern Alaska last summer, and have now completed their field work.

The Juneau gold belt, which includes the famous Treadwell mine on Douglass Island, is found to present many similarities to the rocks of the Mother Lode districts in central California. The component members of the rock series are very similar in character, and, perhaps, are of similar age, being composed of a more or less conformable series of slates and schists, with occasional bands of eruptive igneous rocks. The veins of the Juneau district, like those of the Mother Lode, are usually conformable in strike and dip with the enclosing rocks, but in the Juneau belt there are a larger number of quartzose veins crossing the dip and strike of the country. There are also, as in California, many independent deposits not correlated to the main complex of veins, but lying outside thereof.

Another point of resemblance is that, out of the very large number of veins met with, but a very small percentage carry free gold in commercial quantities, and the continuity of any one single vein is not usually extensive in a lateral direction.

There are now seven productive mines in this belt, three on Douglass Island, and four on the main land, whose united production for 1904 is estimated closely at $2,500,000.

Since the inception of mining (in 1880) the production of the Juneau belt has exceeded the sum of $20,000,000.

The REVIEW begs to suggest to the Department of the Interior the advisability of having a competent man from the Geological Survey, or from the Superintendent of Mines office, sent to familiarize himself with the geological conditions of the Juneau district, and then to commission him to make an investigation and comparison with the slates and metamorphic schists of the Yukon Territory.

The Granby Smelting Co.

The announcement which the REVIEW made several months ago, when Mr. S. H. C. Miner was on a visit to British Columbia, that Mr. J. J. Hill had acquired control of the Granby concern, turns out to have been quite correct, and on his recent return from the West Mr. Miner himself has confirmed the report. As to the effect of this important move on the fortunes of the Granby smelter, the principal result will be a reduction of 25 per cent. in the cost of transportation, amounting to at least $150,000 a year, and there would seem to be no ground for complaint, as the large amount which is invested in the railway enterprise is a guarantee of permanency. There is, however, another side to the question, and one which is wider-reaching in its effects than the interests of the Granby shareholders, and that is the fact that this latest acquisition of the Great Northern Railway is but one link in the chain by which Mr. J. J. Hill is seeking to bind the mining and smelting interests of Southern British Columbia to the Great Northern transportation system. Already arrangements have been concluded for the shipment of Boundary ore in considerable quantities to the Northport smelter, over the new Phoenix and Grand Forks branch. This will be the main factor in yielding a probable profit to the hitherto profitless V. V. & E. Railway, but it will also tend to perpetuate the smelting of Canadian ores on American soil. The distance from Phoenix to Northport is in the neighborhood of 150 miles, and it is stated on good authority that a rate of 50 cents a ton has been made by the railway, although that rate would not cover the actual costs of transportation, and therefore may only be temporary, still it shows the competition with which Canadian railways will have to contend. The control of the largest ore bodies in Southern British Columbia may lead to the smelting of their output across the line, and the enriching of the transportation company which enjoys the longer haul. Another important consideration which must not be lost sight of is that every ton of freight of which Canadian railways are deprived by American competition lessens the ability of the Canadian roads to meet the demands of their customers for lower rates, and thus may retard the development of the province. We are not of those who decry healthy competition, nor consider J. J. Hill a "bogey" man, but we can clearly see that there is a struggle in Southern British Columbia between a Canadian and an American transportation company in which the natural aim of each must be to establish industries on its native soil, and for that reason Canadian interests require special protection, since the enormous disproportion of population and development renders the conflict an unequal one, in which the Canadian interests are bound to suffer defeat by sheer force of circumstances if left to themselves.

Extension of the Lead Bounty Act.

The text of the Order-in-Council which permits the application to exported lead ores of any unappropriated portion of the bounty on lead is as follows :—

At the Government House, Ottawa.

18th day of August, 1904.

Present—The Governor-General in Council :—

Whereas by clause 3 of the Act 3, Edward VII., Chap. 31, intituled "An Act to provide for the payment of bounties on lead contained in lead bearing ores mined in Canada," it is provided that if at any time it appears to the satisfaction of the Governor-General in Council that the charges for transportation and treatment of lead ores in Canada are excessive, the Governor-in-Council may authorize the payment of bounty at such reduced rate as he deems just on the lead contained in ores mined in Canada, and exported for treatment abroad, and

Whereas, it appears that the lead smelters in Canada are unable at present to treat the whole of the lead ores mined in Canada, except at an excessive rate :

Therefore, the Governor-General-in-Council is pleased to order that, after the payment of the full amount of bounty payable under the Act above referred to and amendments thereto, upon lead ores mined and smelted in Canada, and dating from the 1st day of April, 1904, until the 30th day of June, 1905, a rate of 50 cents per 100 lbs. of lead contained in lead-bearing ores mined in Canada, and exported for treatment to Europe, shall be paid, provided that the quantity of lead upon which such bounty shall be paid shall not exceed 11,000 tons of 2,000 lbs. in any one fiscal year.

(Sgd.) JOHN J. McGEE,
Clerk of the Privy Council.

It will be noted that the provisions of the order restrict the amount to be exported to 11,000 tons of lead, and prescribe the importing port to be in Europe. Ore sent to the United States smelters will not, therefore, be entitled to the bounty.

Canadian White Lead.

Mr. Barber, of the Carter White Lead Factory, Chicago, when seen in Montreal lately, stated that arrangements had been completed for the establishment in Montreal of a large lead corroding industry. Satisfactory arrangements have been completed with the Canadian Pacific Railway for the carrying of the product from the British Columbia mines. In this connection the REVIEW is able to say that the old Delorimier Avenue shops of the C.P.R. have been secured for premises, and that the first car load of lead, sent to the Carter Company at Chicago, was so satisfactory that the Carter people wrote to Mr. W. H. Aldridge, manager at Trail, B.C., as follows :—

"We might mention that we were extremely well pleased with the results obtained from this car of electrolytic lead; in fact, the product was noticeably whiter than that produced from refined corroding lead we are in the habit of purchasing. The amount of tailings was also less than is usual. We sent a sample of lead to a chemist at Racine, Wis., and his analysis is as follows :—

Physical and Chemical Analysis.

Lead Carbonate	71.42 p.c.
Lead Hydroxide	28.57 p.c.
or	
Oxide of Lead	86.10 p.c.
Carbonic Acid	11.77 p.c.
Water	2.13 p.c.
Specific gravity	6,562

Volume, 12.53 lbs. per gallon.

"The percentage of carbonate is a little higher than the average, but not enough to cause the slightest trouble. In fact, this analysis shows the finished article to be of very fine quality."

There is, therefore, no reason for doubting the ability of the Trail lead to satisfy all demands of the Canadian market, and the continued importation of dry white lead, practically free from duty, must soon cease.

Obituary Notices.

In the death of Mr. Marcus Smith, of Ottawa, the Dominion loses one of its oldest and best-known civil engineers. Mr. Smith was born at Berwick-on-Tweed, England, on the 16th of July, 1815, and was therefore in his ninetieth year. He came to the United States at the age of thirty-four, and removed to Canada two years later, in 1851. In 1852 he was employed on the location of the Sarnia branch of the then Great Western Railway, and in 1853 was made chief engineer. He returned to England in 1860, and was sent to an important position on the Cape Town and Wellington Railway in South Africa, where he remained until 1865. Returning to England, he was recalled to Canada in 1868, and received an appointment on the staff of Sandford Fleming, then chief engineer in charge of the construction of the Intercolonial Railway.

Mr. Smith resigned this position in 1872, to become deputy to the chief engineer of the Canadian Pacific Railway, and was given charge of the surveys in British Columbia. From 1886 until 1892 he held a position as consulting engineer in the Government service.

The REVIEW regrets to chronicle the death of Mr. John F. Stairs, ex-M.P., of Halifax, N.S. Mr. Stairs died in the Toronto General Hospital on the 25th of September of an affection of the kidneys, from which he had been suffering for some time.

Mr. Stairs was born in Halifax on the 19th of January, 1848, and was in his fifty-seventh year. He was the eldest son of Hon. Wm. J. Stairs, the founder of the firm of Stairs, Son & Morrow, one of the oldest and most responsible ship-chandlering firms in Canada. The late Mr. Stairs entered the firm at an early age, and devoted himself to the development of various local enterprises, which were conspicuously successful.

At the time of the founding of the original Nova Scotia Steel and Forge Company, in 1890, Mr. Stairs was one of the first to join with Mr. Graham Fraser in promoting and building up the Forge Works at Trenton, N.S. He was also president of the New Glasgow Coal, Iron and Railway Company, and was prominent in the amalgamation of these two companies in the year 1895. In all the work of building up the present Nova Scotia Steel and Coal Company from the original Forge Company, Mr. Stairs played a prominent part, and should justly, with Mr. Graham Fraser, be considered as one of the founders of Nova Scotia's prominence in the iron and steel industry.

In politics, Mr. Stairs was a Conservative and strong protectionist.

Notes Concerning Northern Ontario.

A considerable amount of exploratory work has been done this season through Northern Ontario, with a view to ascertaining more fully what it contains in minerals, timber and agricultural lands. Reference has already been made to the valuable discoveries of cobalt, native silver and other ores on the line of the Temiskaming and Northern Ontario Railway, and the full extent of these deposits is not yet known, as fresh discoveries are constantly being made. With the facilities for shipment and getting in supplies which the new line will furnish, these deposits will be vigorously worked. One man who possesses a claim is said to have taken out $70,000 in native silver from a vein discovered only three months ago. Rich ore is being stored in ore sacks until the railway is ready to carry it away. New deposits of nickel have been found, and arsenical ores also abound. A mispickel property is being operated by New York parties, and a Sudbury company is developing an iron pyrites mine.

At Temagami a valuable iron mine has been found close to the railway, in which B. O'Connor, of that place, T. N. Caldwell, of Lanark, and Sir Wm. Mulock have each a third interest. At another point Major Leckie has a deposit of iron pyrites, and copper and gold have been found by prospectors. T. W. Gibson, Director of Mines, Aubrey White, Deputy Minister of Crown Lands, the members and officials of the Railway Commission, and several Grand Trunk and other officials recently drove over the line from the end of the rails to Haileybury, and found evidences of mineral wealth at various points. The writer spent some time on Lake Temagami and adjoining waters last month, where in a number of places prospecting is going on with a certain amount of success.

Farther north, in the Abitibi country, J. G. McMillan, who has charge of an exploring party, reports that in the country so far explored the rocks are Huronian, with few outcroppings. In only one place was the Laurentian formation encountered. Most of the land is level and covered with stratified clay. It is wet, on account of the level nature of the country, but the banks of the rivers are high, so that it can be easily drained, except where there are muskegs, and these do not cover more than one-tenth of the area. These, too, can be drained off, as the peat surface is not deep—from 3 to 6 feet—extending in some places to 10 or 12 feet. In the township of McHart Huronian greenstone was found, varying in appearance, with veinlets of serpentine and a bluish quartzose schist bearing magnetite; in Tully township a greenstone impregnated with pyrites; in Little township a bluish quartzose schist bearing magnetite and pyrites; in Wark and Gowan townships the only rock seen was a hard schist with some stringers of quartz. Glacial accumulations are few. In McHart are some moraines, one being noticed 60 or 70 feet high, heavily timbered with birch. In the south-west quarter of Little there are some sand ridges covered with jack-pine. The rocks along the Abitibi River

and to the south are mostly diabases, diorites and green schists, with outcrops of quartzite.

A writer in the Toronto Globe, referring to the mineral wealth of the Abitibi country, says :—"Evidences of coal, copper and iron are many and prominent. I picked up a nugget of gold half the size of a five cent piece. The Indians tell of a discovery of free gold by Indians some years ago, but the locality is kept secret. Miles and miles of gypsum and mica have been found, also a lake of pitch, which was discovered accidentally by an Indian while chasing a fox."

Not far to the north, and east of Chapleau, on the Canadian Pacific, a tract of good land has been discovered extensive enough to contain eight townships. It contains as good land as any in Ontario, and is well watered and attractive. It lies due east of the Michipicoton iron country, and is evidently a dip down of the clay belt. An immense area of good land has also been located to the north-west of Lake Abitibi and about 150 miles from Lake Temiskaming. The soil is a rich alluvial clay, well suited for agricultural purposes.

These valuable possessions will all be rendered accessible by the Grand Trunk Pacific, the construction of which is now assured. The Temiskaming and Northern Ontario will be open to New Liskeard, at the head of Lake Temiskaming, in a few weeks. At North Bay, its southern terminus, connection is made with the C.P.R. east and west, and with the G.T.R. south. The latter is making a strong bid for the tourist traffic, which comes largely from United States cities, with which connection is made by way of Toronto and Hamilton. It also gives an outlet to many large manufacturing centres which will consume much of the mineral product of this vast undeveloped territory. J.J.B.

Appraisal of the Value of Coal Lands.

By H. M. Chance, Philadelphia, Pa.

(Concluded.)

EARNINGS AS A MEASURE OF VALUE.

The third method is one most valuable for the purposes for which it is used by Mr. Harris, namely, as a basis upon which reorganization may be planned, and a new company financed. It may not be adapted for general use, because it is cumbersome, and also because it does not include allowances for the value of established trade and connections.

The fourth method is useful in a majority of cases as corroborative of valuations reached by the fifth method.

The fifth method is based upon the actual earnings and the ability to maintain output at an increased rate for a long period. Should the value so reached be greatly in excess of the appraisal obtained by valuing the lands at what they fairly are worth, plus the value of plant and improvements, it is evident that the "good-will" or earning capacity is too highly valued.

While it is unwise to appraise at a high valuation the good-will of a purely commercial business, the value of a manufacturing industry producing staple products includes, as one of its most important factors, the established reputation of its products, its facilities for selling and distributing its output and the connections and friendly affiliations with consumers, dealers and transporting agencies that enable it successfully to retain its grasp upon the trade, to extend its operations and to expand and enlarge its business. In other words, an industry of this character can only be valued at its true worth by taking as a whole its property, plant, improvements, reputation of its products, its established trade, selling facilities and connections. Proper investigation having shown that the output of the concerns can be maintained for a long period, even at a rate of production in excess of present shipments, its value as a business proposition may be safely appraised, and in so doing it is customary to assume that the business, including plant and property, is reasonably worth a sum upon which the yearly net earnings will pay a satisfactory return.

In order to confirm the valuation determined by this method, separate appraisals in detail should be made showing the value of the lands, plant and improvements.

VALUE OF PLANT.

It is a comparatively simple matter to fix the value of plant and improvements, because the cost of the materials, machinery and supplies, together with the cost of transportation and erection, or installation, can readily be ascertained. It may, however, be proper to discuss the principles upon which the valuations should be based and what allowances should be made for depreciation.

When the mine has a reasonably long life—i.e., is not approaching exhaustion—the plant and improvements, if modern (adapted to economic operation) and in good repair (in condition to give many years' service, or until the property is exhausted), may fairly be appraised at first cost, including the cost of erection, or at the present cost of replacement, because they are fairly worth this sum if the mine is to continue in operation. If this principle be adopted, no deduction should be made to cover depreciation excepting on those parts of the plant and improvements which have deteriorated in efficiency, or are approaching a condition requiring considerable expenditures for repairs or renewals, or are so old that their usefulness will be of short duration.

VALUE OF DEVELOPMENT.

In assigning values to underground mine development, the life of the mine, its daily tonnage capacity and quantity of coal tributary to it should be reviewed; the first cost of the improvements necessary for working the property, including shafts, air shafts, slopes, etc., should be computed; and a valuation reached approximately equal to the cost of the development and improvements necessary to secure a like capacity under similar conditions at a new plant. This estimate should fairly represent the value to the owner of the underground development work, but in cases where the life of the mine is short, a material deduction must necessarily be made from the appraised value.

In addition to the value placed upon underground development work proper, an additional sum should be included to represent the value of development work or dead-work, that has been done in excess of that required to maintain the output of the mine at its rated capacity. This work usually consists of headings, or entries, driven into new territory from which no coal has yet been mined; and they should be appraised at their full cost. In addition, in some mines a large amount of heading or entry work exists from which the coal has partially been mined; in these cases the work may be appraised at a value proportioned to the quantity of available unmined coal tributary to them. Another item of value which should be included in an appraisal of the value of underground development is the special work provided for future requirements connected with ventilation, drainage, underground transportation and the opening of new territory by means of inside slopes, planes or shafts.

VALUE OF COAL LANDS.

Coal lands should be appraised at what they are fairly worth to the coal operators, including the increment in value due to the fact that the property has been opened and is being worked, but without considering the value of the good-will, or of the plant and improvements. A distinction must necessarily be made between lands already developed, those that can, or are likely to be, developed in the near future, and those the development of which may be postponed for many years.

No rules can be laid down for the determination of fair value. The appraiser must review the prices at which similar property has been actually sold, the earning capacity, mining costs and profits, and the value placed upon the land by the owner, or, in other words, the least price at which the owner would be willing to sell. These factors must be carefully weighed, and his final appraisal should represent an unbiased judgment of the real value.

In appraisals covering large areas in which the workable coal exists under greatly differing conditions of depth, accessibility, quality, etc., the territory should be sub-divided and separate appraisals made of each section. In this way deep territory is separated from that of moderate and shallow depths, drift coal is distinguished from shafting territory, coal of a specially good quality is appraised separately from that of moderately good quality, and thick coal-beds are given larger values than thin ones.

VALUE OF LEASEHOLDS.

In appraising the value of a leasehold it may be assumed that the lessee, having developed the property and being engaged in working it, can be expected to earn as profit a sum at least equal to the royalty paid for the coal. Of course this is a matter capable of being investigated by reference to the books of the operating company—a proceeding which is rarely necessary, because the mining engineer should be able to determine whether the coal can be worked at this profit or not. Upon this basis the revenue derived by the operator would equal, and probably exceed, the revenue received by the lessor, and when this is true it is safe to assume that the right possessed by the lessee to mine the coal is equal in value to the vested right still remaining in the lessor. As it not infrequently happens, in regions being actively worked, that the owners of leased property sell the lands to others subject to the operation of the lease, a means is thus presented for determining the commercial value of the leasehold.

Attention may here be directed to the fact that this latter method of determining the value of the vested rights of the lessor and lessee in property operated under lease, indirectly offers another method for the appraisal of the value of lands, where the coal is owned in fee by the operator; for it may be assumed that, if operated under lease, the coal would command a certain royalty per ton, and the vested right of the lessor in the lease would be marketable at a nxed price per acre; further, that the vested right of the operator in the lease would be worth a certain price per acre. Merging these two interests into one, the value of the lands as owned in fee may be taken as equal to the sum of the values if operated under lease.

FACTORS AFFECTING THE VALUE OF COAL LANDS.

Before proceeding to an appraisal of coal land values, the engineer must familiarize himself with the quality and quantity of coal available, the thickness of the workable beds, the cost of mining and of transportation, the mining conditions presented by the district, the character of improvements required, and other conditions affecting the industry as a whole, in the region concerned. In the following paragraphs an attempt has been made to discuss briefly the principal factors which should be carefully investigated. While much of this information may appear unnecessary to the engineer, because the facts may seem self-evident, his clients, and others, may have merely a superficial knowledge of coal mining, and may need enlightenment upon the most simple matters.

1. Quality of the Coal.—Coal of superior quality commands a higher price, assures a ready sale, retains the trade and insures a large output and a low mining cost during times of depression. Coal of poorer quality rarely brings as high a price and is difficult to sell, especially when the trade is depressed; large commissions must often be paid for selling it, and the reduced shipments with irregular operation of mines, due to lack of orders, materially increase the mining cost per ton.

The same considerations apply to coke. Therefore it is evident that quality is a factor of prime importance.

2. Thickness of the Coal.—To compete successfully with other operators, it is essential that the beds to be worked should be as thick and as free from troublesome slate-partings, and that they should exist under conditions as favorable to cheap mining as the average present conditions at a majority of mines in the same district.

Other conditions being equal, the thicker coal seams, and those containing little refuse, can be mined at a lower cost than those thinner or more impure. In each district, experience determines the proper thickness, character and quality necessary to constitute a workable coal bed, that is, one that can be profitably mined.

It follows, as a matter of course, that in each district as the thicker and better beds become exhausted, and competition from them eliminated, the thinner and more impure beds will become workable.

In appraising the value of the coal property, it is customary to include only those coal beds that are now, or shortly will be, workable; and to ignore the thinner and impure seams. For the reason that past experience has proven that in time the latter will become valuable, attention should be directed to this additional asset of large prospective but of indeterminate present value.

3. Cost of Mining.—The cost of mining is a most important element. It is not essential to success that the mining cost at any operation should be low as compared with the region or State in which the mine is located; but it is important that the cost should not exceed the average of the district in which it is located. This statement is true because coal from each district usually has a definite market, i.e., the market is limited to certain districts, certain railroads, or to a certain class of consumers who are best suited by the coal from that particular district; and coals from different geographic districts commonly do not compete in open market upon an equal basis, except where the transportation companies make compensating differences in freight rates, in order to enable the miner to deliver coal from a district where the mining cost is relatively high at the cost of a more cheaply mined coal from other districts.

4. Transportation.—The question of transportation enters vitally into every discussion of values. Coal land so located that it cannot be reached by railroad at a reasonable cost, or owned by persons not commanding sufficient capital, or influence, to secure the building of a railroad, is of small value. Coal underlying farm lands situated at a distance from existing railroads is of little value so long as the ownership remains

vested in the farmer, or those unable to secure its development.

5. Ownership.—As already indicated, the value of a coal property is affected by ownership. If the coal is owned by those able to mine it quickly, the value is greater; if it is to remain untouched for a long period, or to be worked on a small scale, the value is less. The concentration of large holdings into one corporation increases the value of the whole as a unit to a sum far greater than the sum of the values of the individual tracts, because a corporation can establish selling agencies at all important distributing and consuming centres; can spend large sums for advertising; can form close affiliations with manufacturing and transportation companies; can retain able counsel and employ the best managers and representatives that can be found; can own its cars and can make whatever outlay may be necessary to build up a large and permanent business.

6. Geographic Position.—Under this heading it is sufficient to direct attention to the fact that those areas of workable coal, situated on existing lines of railway nearest the largest markets, must always be more valuable than territory remote from the large consuming centres. This fact is of especial importance with reference to lands situated upon any of the main trunk lines of the United States, and to those near the great manufacturing centres of the country or most accessible to tide-water trade.

7. Quantity of Workable Coal.—It may seem rather paradoxical to assert that the larger the territory controlled by one corporation, the greater the value per acre of that territory because attention has elsewhere been directed to the fact that the value of coal property is greater where the coal can be quickly mined, than when its extraction (and the returns therefrom) must extend over a long period. This latter statement must be confined to properties of relatively small size, and is undoubtedly true of small properties. But the advantages accruing from the consolidation of ownership of large tracts under one management outweigh these considerations; because the large control justifies extensive improvements and developments of a more permanent nature, and enables the owners to expend large sums in providing facilities for the upbuilding of a large trade, which necessitate extensive advertising, the establishment and maintenance of offices at all large distributing and consuming centres, and the employment of able managers for the conduct of the business. For these reasons the value of the coal land within certain limits increases with the acreage controlled under one management.

8. Mining Conditions.—The factors affecting the cost of mining are—(1) actual cost of mining operation; (2) possibility of planning large development with improvements of permanent nature; (3) output possible from each operation; (4) the capital required for the plant and its development. These items depend upon many other conditions besides the thickness and purity of the coal; among which may be noted—the depth at which the coal is found; the dip, pitch or slope of the bed; the quantity of water to be pumped, or the facilities for draining it away from the lands; the relative ease or difficulty of maintaining efficient ventilation; the character of the roof and the floor of the coal bed; the hardness of the coal; the presence of gas in the mine; the character of the coal-dust (whether readily explosive or not); and the presence or absence of faults, rolls, and other disturbances affecting the regularity of the coal bed.

It not infrequently happens that, while the quality and thickness of a coal bed may be all that could be desired, other conditions may exist which render the bed almost, if not absolutely, unworkable under existing competitive conditions of other mines. These objectionable conditions are—extreme depth or dip, troublesome faults or rolls, bad roof, soft floor, a great quantity of gas, a large quantity of water to be pumped, and troublesome dust.

9. Character of Improvements.—The value of any coal property is affected by the cost of installing the plant necessary for its efficient development. If this plant be small, simple, quickly erected and inexpensive, other things being equal, the property will have greater value than if a large, complicated and expensive plant be necessary.

The character of the improvements needed depends somewhat upon the uses to which the coal is to be put. If it is to be sold for steaming purposes (as run-of-mine coal) a very simple tipple is required. If it is to be sold in markets demanding screened coal, or if the seam contains objectionable impurities which must be removed, screening and cleaning devices must be installed, which require outside improvements of considerably larger cost than in the former case. Should the coal be especially adapted to coking, and the mines situated in a district where the economic conditions render it necessary, or desirable, to transform the coal into coke, the erection of coke ovens, and possibly also of cleaning or washing appliances may be unavoidable.

10. Market Reputation of the Coal.—Under this head it is desired merely to recall the fact that the name of a coal bed may be as valuable to the operator as is a trade-mark, brand, or copyrighted name, to the manufacturer of any well-known article or product. Furthermore, the mere location within the boundaries of some districts is an asset materially enhancing the value of coal lands. This is a matter of great importance in the appraisal of coal properties in the older districts, because it may enable the operator to find a ready market, and to derive large benefit from the established reputation of coal from other mines and from other coal beds in the same district.

Some Recent Rock Movements in the Laurentian and Huronian Areas.*

By S. Dillon Mills, Toronto, Ont.

As our ordinary life experience and the records of mining developments from the earliest known works down to the present day show the earth's crust to be practically in a position of stability, there has arisen naturally an idea that the period of instability has long past away and that since the glacial period, at all events, no movements other than those of volcanic origin have taken place. At least, this used, to a great extent, to be my own attitude of thought on the subject, and I have no doubt that others would agree with it; but since I commenced the study of the Laurentian and Huronian districts of Ontario some years ago, a contrary conviction has been gradually forcing itself upon me as regards even these apparently most solid areas of the earth's surface. With the idea that, in looking upon glacial action and atmospheric erosion as the only formative agents in the shaping of the picturesque features in the wilder districts of our land (where so many of our citizens go yearly to enjoy the varied scenery and to cast off for a brief period some of our city-made civili-

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zation, the white man's burden) we have been laying upon the icebergs and glaciers of the past a load sufficient to reduce them to a condition of harmless quiescence. I may here remark that I believe we should, in case of our Canadian archaic areas, make a distinction between the glacial period, when this and other parts of the now habitable earth were covered by immense quantities of ice thousands of feet in thickness, according to some authorities, when there could be in these districts, owing to absence of elevation, no motion and no erosion; and that period when were produced those glaciated surfaces and striae, with which we are all so familiar. The period when these were produced must have been one of submergence in flowing waters, with tides or currents bearing ice floes laden with gravel and boulders, and with seasons of warmth, when the grounded ice melted, and deposited its load; possessing, in fact, a climate but little different from, and conditions very similar to, those now existing in the Georgian Bay, but with perhaps stronger currents. If the Georgian Bay Islands were subject to the strong currents, which have left their mark, in the shape of sand bars and boulder-strewn gravel-reefs, high above some of the fertile lands of Central Algoma, they would show much greater evidence of recent glacial action than they do to-day, if, indeed, any remained to tell the tale.

As mining engineers we are not specially interested in picturesque scenery, but the few facts to which I wish to call your attention may be found to have some interest in connection with the condition of the country, rocks, location of shafts, etc. It is by attention to little things that we arrive at knowledge.

To save time I will limit myself to observations made recently at two points. The first in Haliburton County, Ont., the second in Gladstone and Patton townships, Algoma.

In that portion of Haliburton County, near Wilberforce station, on the Irondale, Bancroft & Ottawa R.R., one of the most picturesque features of the scenery is Lake Farquhar, which is bounded on the south by a rocky ridge of considerable height, broken by peculiarly formed rocky ravines which have their eastward or south-eastward sides precipitous, in some places perpendicular, from 100 to 150 feet in height, while the westerly sides are gentle slopes of 15 to 20 degrees. The rock on the summit of the steep side is rounded by glacial action, but not the edge of the cliffs; near the bottom of the gentle slope, on the opposite side, the rocks show indications of the same action, but I do not think the valleys can have been formed in this manner for the following reasons : First, the shape of the valley could not be explained on the glacial theory except by a difference in the hardness of the rocks; now, in some places, there is no difference in resisting quality, and in some places the soft rock is at the summit. Secondly, the absence of indications of glacial action on the faces of the steep cliffs might be accounted for by supposing the glaciated face to have fallen in consequence of weathering, and the point must be conceded in places where there is much talus at the foot of the cliff, but in some places there is none. Thirdly, that at the bottom of one valley wider than the rest there are three hog-backed ridges of gneiss, shaped evidently by glacial action, running not lengthwise, but across the valley, one of them running almost to the base of the cliff; looking as if they had been furrowed out while in a position higher than the present summit, and had then dropped by a gradual movement, or series of movements, to their present position. The evidences of these movements are abundant. There are indications of at least four different outlets from Lake Farquhar, each at very different levels, one of them terminating in a beautifully rounded pot hole about 12 feet in diameter by 8 feet deep, situated on the south side of the rocky ridge probably 90 feet above the present outlet.

In view of these facts, we seem driven to one of two conclusions : First, that the rock movements which formed these ravines took place prior to the glacial era, that the ravines were filled with solid ice, so protecting from glaciation all but the summits of the ridge, till, towards the end of the ice age, when this anchor ice moved out, grinding out the bottoms of the ravines as it went, at the same time gradually lowering the outlets from place to place. But this does not appear satisfactory in view of the great length of time during which the level must have remained stationary in order to allow of the great wearing action which has taken place at each separate outlet; the direction of the "hog-back" of gneiss above mentioned also is against this explanation. There remains then only the original supposition, namely, that the changes of level have occurred since the glacial period, this view receiving additional support from the fact that the sand-bar formed by the current from the outlet which preceded the present one is still visible in the alluvium to the south of the ridge, that outlet being now about 30 feet above the present natural lake level.

There are numerous exposures of Laurentian crystalline limestone in some parts of this neighborhood which have by their gradual weathering caused many changes in the appearance of the scene, but the ridge through which the ravines pass consists of a medley of gabbro, pyroxenite, gneiss and intrusive binary granite, limestone being found only in one place on the outer or south side of the ridge.

Turning now to observations made in Algoma, in the Huronian of Gladstone and Patton townships, some time after my first visit to Lake Farquhar, I was sent to Gladstone township to report on some development there in progress on a copper property near Iron Bridge P.O., and found part of the work to consist of a shaft 8 x 12, then about 45 feet deep, sunk on the south flank of a rocky knoll near the upper end of a small sloping ravine extending up the side of the main ridge, which rose in places probably 250 feet above the farming lands on the south-west; the east and west ends and north side of the shaft were in good solid rock, but the south side was completely shaken up; the shaft had been sunk on a lead of quartz carrying a fair amount of chalcopyrite, the lead was very irregular, without partings, being frozen to the rock on both sides. Both it and the country rock, an intrusive syenite, showed evidence of secondary movement in small fissures filled with secondary quartz formation carrying a little chalcopyrite occasionally, but the shaken condition of the south wall was evidently caused by a still later movement, as the seams remained uncemented except by a little limey matter in places. No evidence of this movement could now be seen at the surface, as the rock at that side was completely covered by the dump. Had this rock been properly examined in the first place by anyone who understood these rock movements, the shaft would never have been sunk in this place, and a loss of $1,500 would have been avoided. East and west of the shaft a dense growth of underbrush extended for some distance, with a few large trees. To the north, about 40 feet from the shaft, rose a perpendicular face of rock 15 to 20 feet in height; the top of this rock had the ordinary rounded appearance of these glaciated hill tops, and extended between 20 and 30 yards northward, then dropping at a slope of about 45 degrees to a sloping wet swale about 80 feet below. To the westward it extended probably 150 yards, then dropping perpendicularly about 90 feet, to a sandy ridge, heavily tim-

bered, which stretched westward for some distance, bounded on the north by the swale above noted, and sloping south to the general level of the cleared land. The shoulder of rock on which the shaft was located presented somewhat the appearance of the slips so common in tidal harbors, forming a sloping causeway; it dipped down westward beside the wall of the upper bluff till it reached the level of the sandy ridge, but it was covered mostly with earth and debris from above. Where the rock was exposed it showed the same glaciated appearance as the upper rock, and was full of small stringers of quartz with traces of chalcoyprite running parallel to the bluff wall, east and west approximately. The dense growth of leafy underbrush and the presence of the earth over most of the rock prevented my gaining any further knowledge as to the rock structure at that time, but, having occasion to visit the place early in the spring following, I made a further examination of the matter, and found that nature had assisted me in an unexpected manner. A few yards west of the side of the shaft a large pine tree of probably sixty years' growth had been blown down, lifting a great mass of earth in its matted roots, laying bare the rock beneath and showing a sharp edged step down about three feet in depth, at the bottom of which was another glaciated surface similar to the upper one. The cleavage had taken place along a stringer of quartz parallel to the upper bluff; in some spots the quartz had remained, adhering to the face of the step; in others it had gone down with the lower rock. There were indications of a further drop outside this, but the depth of earth was too great to admit of examining it without an expenditure of much time and labor.

Shortly after this, while walking along through the bush to the south-west of the shaft, near the lower end of the little ravine, I came upon an exposure of reddish felsite rock, showing a line of sharp fracture running nearly north and south. A little examination showed that it ran for a considerable distance in this direction, and detached masses along its face (the edges of which were as sharp as if broken quite recently, some of the fragments having dropped 18 inches, some more) showed that here also had been a rock movement coincident probably with the other. The upper surface of the rock in situ, and of the detached portions, was beautifully smoothed by glacial action, and the position of the fragments showed that there had been no lateral motion (by a sufficient lifting power they could have been fitted again to the places from which they had dropped). The accumulation of earth and debris prevented the total drop being ascertained, but it may have been anything over ten feet. In this district we have, therefore, evidences of four different periods of action which have combined to give the present surface configuration.

First—That in which a series of fractures occurred producing gradually the disconnected rents and chasms running nearly east and west, which were then filled with quartz, calcspar, siderite, etc., with chalcopyrite.

Second—Another period of dislocation causing the secondary formation of stringers or small veins already noted, and a movement of greater extent along lines running north and south so that the veins cannot be traced beyond these faults in some cases. This latter north and south dislocation may have been later than the east and west one; this I have not yet been able to determine, but it was prior to the glaciation period, and to it the country owes its most striking feature in the way of cliffs and ravines. The results differ from those in the Farquhar district in that the cliffs are on the west side of the north and south ravines instead of on the east and the upper edges, where not changed by falls of rock occasioned by frost cleavages, etc., show the glacial rounding very distinctly. In tracing the course of one vein, I came to a spot on the lower shoulder of a cliff, overhanging a ravine, where the alluvial matter and the rocks debris had formed a slope up to, and over, the edge of the lower cliff. On removing the upper part of this I found a vein, consisting here of calcite and siderite chiefly, about three feet wide, showing a beautifully rounded shoulder on the edge of the concealed cliff, which here showed, so far down as I was able to have it exposed, a smooth glaciated perpendicular face, and beyond this point the vein could not be traced with any certainty (though another vein occurs about 400 yards to the eastward and about 150 yards north of the true line), till it reappears about 1½ miles to the eastward on the same line. If this property is ever developed, it will be an interesting point to decide if there has been any lateral motion in this case, or only a downward drop of an area about half a mile in width.

Third.—This period is the glacial era when the rugged outlines produced during the two or (as the case may be) three previous periods were rounded off to something approaching their present aspect.

Fourth.—Another period of gradual dislocation, which perhaps still continues in operation.

There is here much that is puzzling, yet worthy of protracted investigation—the movements have not been coincident over large extents of territory; the movements in Algoma have, for instance, not coincided with those in Haliburton, while in the intervening Sudbury district there may have been only one movement (this I have not investigated); in fact, in some cases, a difference may be found within the limits of a few townships. That this has always been the case is shown by the difference in the type of vein prevailing in different parts of Algoma. At Bruce Mines we have a series of well defined veins curved and twisted in various directions, mostly of considerable width, with well defined walls, carrying a low percentage of copper. In Gladstone and Patton, veins showing dislocating action along east and west lines, traceable for eight or ten miles in one straight line with occasional gaps as above noted, carrying a much higher percentage of copper, and offering the peculiar feature that while practically continuous and forming parallel lines across the country at various distances apart, the veins at the surface pass from fissure to fissure as if the rending force, while acting along the general east and west course, had in some places produced fissures slightly diagonal to that course, differing from it by 5 degrees to 10 degrees. The ore deposits in those fissures centre about on the general east and west line, but are too thin and too much elongated to be properly called lenses. Then further east we have the more lense-like formation of the Massey district, while at Sudbury we have a totally different formation as shown by Dr. Coleman in his very interesting report on that district.

The subject is a somewhat difficult one to investigate owing to the impossibility of doing any satisfactory work when there are leaves on the underbrush or snow on the ground, so the time available becomes practically limited to an average of a month or six weeks in the year. If these movements had been noticed in a limestone formation, or in a district showing evidence of volcanic agency, or recent subterranean chemical action, I would not have thought it worthy of particular notice, but in the districts spoken of, where all such agencies seem to have been at rest, since the formation of the mineral deposits, it would appear as if something remained yet to be learned in this direction, by those who desire to look more deeply into the workings of nature. Perhaps

the new geology, with its theory of the subterranean origin of water springs, may account for the movements above noticed.

Rate of Solution of Gold in Potassium Cyanide.*

By T. H. PLUNKETT, School of Practical Science, Toronto, Ont.

Authorities on the use of the cyanide process as an extractor of gold from its ores, while being unanimous in the opinion that potassium cyanide can only be used on fine gold, have made few attempts to define the exact limits of fine and coarse gold. These terms, fine and coarse gold, so commonly used in discussing the merits of the several methods of gold extraction, are very indefinite. While authors do not hesitate to assign certain processes of extraction for fine, and others for coarse gold, no one seems to have endeavored to find a limit so as to be able to state definitely to what extent certain processes can be used to advantage.

Having had occasion to use this process on different ores, the writer has made several experiments to find what effect cyanide solutions have on particles of gold of varying sizes. This effect varies greatly with the manner in which the solution is applied. Estner made it clear that oxygen was an essential element to enable the potassium cyanide to do its work. It has also been suggested, by recent writers, that temperature played a part in the extraction.

With these points in view, the writer has treated the gold in three ways. First, by allowing the solution to percolate around the gold. The gold bead was placed in a porcelain dish containing the solution and the latter was drawn off at intervals of an hour or two to enable it to absorb oxygen from the air. Second, air was made to bubble through the solution while in contact with the gold. Third, the solution, with air passing through it, was heated to about one hundred degrees Fahrenheit.

In preparing the gold particles a known weight of the metal was dissolved in aqua regia and diluted with water to five hundred cubic centimeters. Certain volumes of the solution were then taken, and the nitric acid boiled off, after which it was evaporated to dryness on troughs made of pure lead foil. The lead was then cupelled, leaving beads of gold, spherical in form. These were carefully weighed, and their diameters measured under a microscope.

A three-tenths per cent. cyanide solution was used in the following experiments :

RESULTS OF EXPERIMENTS.

Weight of Bead	Average Diameter	Process	Time	Weight Dissolved
.800 mg.	.455 mm.	Percolation.....	16½ hours	.040 mg.
.800 "	.455 "	Agitation.....	16½ "	.180 "
.800 "	.455 "	Agitation and Heat	16½ "	.250 "
.300 "	.299 "	Percolation.....	7 "	.007 "
.300 "	.299 "	Agitation.....	7 "	.080 "
.300 "	.299 "	Agitation and Heat	7 "	.100 "
.170 "	.260 "	Percolation.....	3 days	.100 "
.170 "	.260 "	Agitation.....	16 hours	.070 "
.170 "	.260 "	Agitation and Heat	7½ "	.080 "
.130 "	.247 "	Percolation.....	3 days	.080 "
.130 "	.247 "	Agitation.....	20 hours	.130 "
.130 "	.247 "	Agitation and Heat	16 "	.130 "
.110 "	.208 "	Agitation.....	16 "	.060 "
.110 "	.208 "	Agitation and Heat	7½ "	.060 "
.100 "	.201 "	Percolation.....	3 days	.088 "
.100 "	.201 "	Agitation.....	16 hours	.070 "
.100 "	.201 "	Agitation and Heat.	12 "	.100 "
.070 "	.195 "	Percolation.....	3 days	.070 "
.070 "	.195 "	Agitation.....	16 hours	.070 "
.070 "	.195 "	Agitation and Heat.	10 "	.070 "

*Paper presented in Competition for Prize Medal at the Sixth Annual Meeting of the Canadian Mining Institute, 1904.

From these results it ould seem that agitation and agitation aided by heat have a decided advantage over the percolation process, while agitation aided by heat has a less decided advantage over agitation alone. To obtain an extraction in a reasonable time, beads of about .100 m.grams in weight, with an average diameter of .201 mm. seem to be the maximum size.

Another Australian Zinc Process.

The Potter zinc process devised by C. V. Potter, and now in use on one of the Broken Hill mines, is recently described at some length by the Australian Mining Standard. Summarized, the process follows :—Dry ore in a fine state of division is fed in a thin stream into a hot dilute acid solution contained in a shallow vessel which forms the body of the machine. The ore is drawn along the bottom of this vessel and discharged by rakes formed of wire attached to suitable chains. The bottom of the machine is covered by deflector plates arising from a short distance above it. Some of the plates are joined together at the bottom, forming troughs, while the adjacent plates overlap them, leaving a small space between at the top. As the ore passes along, the action of the acid upon it generates gas, the bubbles of which attach themselves to the zinc-blende, and raise the particles to the surface, the gas there disperses and the blende falls into the trough, along which it is drawn to the discharge end by suitable scrapers attached to a chain, and is thus recovered in a very clean state.

Commercial Wet Lead Assay.

Some months past a Colorado organization, to which belonged many of the assayers and chemists connected with the larger mining, metallurgical and chemical-manufacturing companies of Colorado, took up the subject of the wet lead assay, with a view of working out a method which would be uniformly used, and which would do away with the differences now arising over the employment of various methods of arriving at the true lead contents of ores. Since the matter was first taken up, little has been heard from the special committee having the task in charge, although it is known that uniform samples of representative ores were distributed to all those agreeing to assist in the work. H. A. Guess, of Silverton, Colo., has prepared for the next meeting of the American Institute of Mining Engineers, to be held next month in the Lake Superior country, a paper on the "Commercial Wet Lead Assay," from which the following paragraphs are excerpts :

"For a number of years I have used for the commercial wet assay of lead generally the ammonium molybdate, and occasionally the ferrocyanide method. These well-known methods need no detailed description here. In the ore-selling and ore-buying establishments of the West, 90 per cent. of all wet lead assays are made by one or the other, and at least nine-tenths of this proportion by the molybdate method.

"A procedure so well-established must have merit; and, in fact, the ammonium molybdate method, when applied to siliceous ores or products of fairly high grade, has proved itself both rapid and accurate to a satisfactory degree. Yet those who use it most constantly clearly recognize its weaknesses in certain respects and under certain conditions; and I believe that a method free from such weaknesses would be welcomed by analysts. In this belief, I submit the results of my laboratory experiments, covering a period of nine months, during

which a new method was developed, and more than 2,000 wet lead-assays were made by that method, on various ores and under purposely varied conditions, in order to determine the conditions necessary to accuracy, and to test the applicability of the method to all kinds of pure and impure lead ores and products.

"One weakness of the ammonium molybdate method is the end reaction with the indicator—a freshly prepared solution of tannin. The usual practice is to titrate at boiling heat, and, for a high percentage of metal, to make a second boiling after getting a faint end reaction, and then to finish to a complete end tint. The correction for the indicator is, to some extent, affected by the personal equation involved in the operator's conception of a perceptible yellow tint, and varies among different analysts from 0.3 to 0.5 cc. of a standard solution of which 1 cc. equals 10 mg. of lead. It is evident that while this is quite permissible with fair grade ores (and at the same time have different operators check quite closely enough for commercial purposes), it is an entirely different matter in dealing with tailings, containing, say, 0.3 per cent. lead, in which the variation in the correction used for the indicator would represent practically the total quantity of lead present.

"A somewhat extreme instance showing this weakness came under my notice a few months ago. A series of samples of siliceous tailings, carrying from 0.3 to 0.5 per cent. lead, were sent for checking purposes to a leading umpire assaying establishment in the West, with the statement that they were tailings for wet lead-assay. The report was, for about half of the lot, 'trace'; for the remainder, 'none.' The analyst wrote us that the ammonium molybdate method had been used, and that, although he could see fine galena in the tailings, and could even pan it out, he had found, on assaying, that the number of drops of molybdate solution necessary to react with the tannin was in each case no more than the correction amount for indicator; so that he was forced to make the report as he did.

"Assuming that the amount of ammonium acetate used, and the bulk of solution for titration, were at the minimum limits for such fractional percentages, it is probable that if, in these cases, the analyst had given his flasks a prolonged boiling after adding the first few drops of molybdate solution, he would have found that his end tint had faded sufficiently to accommodate a few additional drops of the standard solution. This would have given him, above the indicator requirements, a small fraction which he could then have labeled 'lead.' A result, however, which has to be squeezed out by such labored and uncertain efforts is neither gratifying to the analyst nor really valuable to his client.

"Furthermore, the lead molybdate precipitate being white, and the practice being common among analysts of not pouring the ammonium acetate solution through the sulphates on the filter, but of depositing filter and all in the original flask, digesting therein with ammonium acetate, and then titrating, it follows that, with only slight traces of lead present, there is no proof positive to the eye that the few drops of molybdate added really found any lead to precipitate, the solution being turbid from the slimes of the filter. The analyst is in doubt whether to report, say, 0.2 per cent. of lead, and chance it; to compromise on a 'trace'; or to make a clean sweep and say 'none.' This hypothetical case may be considered by many as overdrawn, but I know from personal experience whereof I speak.

"The other main and commonly occurring weakness of the molybdate method is shown in dealing with ores containing large quantities of lime. Should the percentage of lead be fairly large, say 5 per cent. or more, the molybdate method does very well; but with small and fractional percentages of lead, all the above-cited troubles occur and are aggravated by the tedium of washing the bulky precipitate of pasty calcium sulphate derived from the sulphuric-acid evaporation. Ores of this class are common in south-eastern Missouri; and, although remarkably pure in the sense of containing little else than galena in slightly siliceous dolomite, they have given much trouble to analysts who have to look for fractional percentages of lead in such material.

"Some years ago, having experienced difficulties somewhat analagous to those above mentioned, I gave up the using the molybdate method on material containing less than 1 per cent. of lead, and for some time employed a method of precipitating those small amounts of lead from the hot, filtered ammonium acetate solution (after it had been acidified with hydrochloric acid), on a strip of pure aluminum free from silicon. The precipitated lead was removed from the aluminum strip by rubbing, washed, dried at 110 degrees C., between filter papers, and weighed as metallic lead. This method is tedious if many determinations are to be made, and it possesses several disadvantages, not the least being that, when the quantity of lead present exceeds from 20 to 30 mg., small portions of the lead film are liable to become detached before the operation is completed, and, floating around in the acid solution, to be slowly re-dissolved.

"The result of many trials led me to experiment with the precipitation of lead as chromate under various conditions; and this method, as finally elaborated and tested, has proved so rapid and satisfactory in every way that I have discarded all other methods, and use this not only for small percentages of lead, but for all wet lead-assays, on whatever material.

"The insolubility of lead chromate in water, and in dilute acetic acid, is well-known, and the gravimetric method of estimation by chromatic precipitation has been in use to some extent for years. Modifications, looking to the development of this method into a volumetric one, have also been published; but the fact remains that, at the present time, the volumetric chromate method as a commercial wet lead method is practically unknown.

"Taking advantage of the reactions of lead chromate, together with such literature as bore upon the subject, preliminary trials were made. A solution of normal potassium chromate was generally used, although dichromate in some cases answers as well, the normal chromates being converted to dichromates on addition of acids; but as I have generally used the normal chromate for the precipitating solution, and as its equations are somewhat simpler, I will consider it here.

(1) $K_2CrO_4 + Pb(C_2H_3O_2)_2 = PbCrO_4 + 2KC_2H_3O_2.$

"The potassium chromate solution is added in slight excess of the fine quantity necessary to precipitate all of the lead; the lead chromate is separated by filtration and washing; the filtrate containing the excess of chromate is acidified with about 25 cc. of dilute hydrochloric acid (1:1); a small crystal of potassium iodide (about 0.5 g.) is then added; and the liberated iodine is titrated with a standard solution of sodium hyposulphite in the usual manner, running-in the 'hypo' until the brown color of iodine is almost discharged. Then a few drops of starch paste are added, and the titration is continued until the blue color is just discharged, and a clear solution remains. The standard hyposulphite solution is preferably made of such a strength that 1 cc. will equal 0.5 cc. of chromate solution, in order to afford an easy calculation of

the back titration, in terms of chromate. The equations of the back titration are :

(2) $2K_2CrO_4 + 6KI + 16HCl + 10KCl + 2CrCl_3 + 8H_2O + 3I_2$.

(3) $6Na_2S_2O_3.5H_2O + 3I_2 = 6NaI + 3Na_2S_4O_6$.

"Equation (1) shows that, of a solution of K2CrO4 of 9.396, or approximately 9.4 g. per liter, 1cc. will precipitate 10 mg. of lead. If the dichromate solution be used, it should contain 7.12 g. to the liter, in order to give the same strength. Equations (2) and (3) show that, of a solution of 'hypo' of 36 g. of the pure crystalized salt to the liter (or 18 g. to the liter, if the more desirable half-strength be used), 1 cc. equals 1 cc. of the chromatic standard. This is very nearly the strength of the standard 'hypo' in common use for the iodide assay for copper, and if only a small number of wet lead-assays are made daily, it may be more convenient to use the copper 'hypo' solution for the back titration of the chromate; in the latter case the factor necessary to convert the copper 'hypo' solution to terms of chromate is about 0.54, the exact factor being readily ascertainable by standardizing the one solution against the other.

(To be continued.)

The Cassiar Coal Co.

The Cassiar Coal Development Company, with headquarters at Toronto, is pushing work on its coal areas which were discovered some three years ago. These areas lie in the Babine Range, north of Cariboo, and are reported as being only fourteen miles from Kitimat Harbor. The near advent of the Grand Trunk Pacific Railway Company is the cause for the development, as there is, at present, no possible outlet for the coal. Five valuable seams, of which two measure 16 feet and 20 feet in thickness respectively, are said to occur in the fifty-two square miles now licensed to the Cassiar Coal Company. Prof. A. P. Coleman, of Toronto, is reported to have examined the areas this summer, and to have a favorable opinion of their value.

The officers of the company are well known men of good standing. The president is the Hon. John Dryden, Minister of Agriculture for Ontario ; the vice-president is Mr. R. Y. Ellis, of the Crown Bank, and Mr. W. Munns, Toronto, is the secretary. Both the local members from Hamilton are on the Board of Directors.

The Company has a paid-up capital of $300,000.00, and hence is in a strong financial position. Of this sum, $200,000.00 has been set aside for the purchase of the area now held under license, and $100,000.00 has been appropriated for the development of the coal seams. Over $20,000.00 of this has already been expended on the property.

The Shakespeare Mine Accident.

W. E. H. Carter, of the Ontario Bureau of Mines, attended the inquest held by Dr. Flaherty, coroner, on the bodies of six men who last month lost their lives at the Shakespeare gold mine, near Webbwood, Ont. The accident is one of the most serious that has occurred in mining in New Ontario, and the Department was anxious that there should be a full investigation, in order that the responsibility should be placed where it belonged.

The Shakespeare is a newly developed gold property, which was opened up a year ago by T. W. Trotter, and sold to J. D. Miller, who subsequently sold to the Shakespeare Gold Mining Co., retaining a large block of the stock. The shaft is perpendicular, 100 feet deep. On the morning of the accident the bottom of the shaft was filled with the heavy gas which follows a blast. The natural ventilation of the lower workings has always been poor, and it has been customary, after each blast, to blow in air under pressure to remove the poisonous gases. This had not been done on the day of the accident. Four miners who descended by a ladder were overcome and called for help. The engineer, instead of turning on the air blast, also descended the ladder, to be in turn overcome by the gas. The manager, Mr. N. McMillan, who had been in charge only eleven days, turned on the air, and, after waiting fifteen minutes, proceeded to investigate. He also was asphyxiated. The verdict of the coroner's jury was "Accidental death by suffocation owing to neglect of the company to provide proper ventilation." The mine had been inspected three weeks before, and the ventilating apparatus found to be in good order. It appears, however, that it is somewhat expensive to operate the apparatus, and that some miners make a practice of doing so only at intervals. The miners who lost their lives were prompted by curiosity to visit the place to see what the blast had disclosed. The engineer neglected to turn on the air before descending, and the death of the manager, Mr. Carter declares, was an act of deliberate self-sacrifice. Mr. McMillan, who was only thirty-four years of age, was inexperienced in mining, being by profession an accountant. He had been business manager of the Mikado, in the Lake of the Woods district, for nine years. With the appointment of Mr. McMillan to the Shakespeare, arrangements had been made to push development work more vigorously than ever and to erect a stamp mill. The accident is a most regrettable one, but we hope it will have its salutary lessons as to mine ventilation.

PERSONALS.

Mr. Eugene Coste, President of the Canadian Mining Institute, returned to Toronto during the month, but was called to Manitoba again, where he is making some investigations into possible territorial petroleum fields.

Dr. H. M. Ami, of the Geological Survey of Canada, recently made an investigation of the oil wells in the vicinity of Moncton, N.B., and has reported favorably on what he saw.

Much satisfaction continues to be expressed at the election of Mr. G. G. S. Lindsey as General Manager of the Crow's Nest Pass Coal Company. Mr. Lindsey is also third vice-president of the Company, as well as being its legal adviser, and will probably be a resident of Fernie for a portion of each year.

The Canadian Manufacturers' Association elected Mr. W. K. George, of Toronto, to the presidency of that association at the closing session on Thursday, the 22nd September. Mr. George is well known in the silver-plate trade, being the managing director of both the Simpson, Hall, Miller Co. and of the Standard Silver Co.

Mr. Homer N. Galer, manager of the International Coal and Coke Company, at Coleman, Alberta, was married to Miss McLaren at Carson on the 20th inst.

Mr. J. D. Kendall, the eminent English mining engineer, advises that after October 1st his London offices will be at Mansion House Chambers, Queen Victoria Street, London, E.C.

Professor Coleman, of the School of Practical Science, Toronto, recently made an examination of the nickel deposits in Northern Ontario, for the purpose of making a full report to the Provincial Department of Mines. T. W. Gibson, of the Bureau of Mines, accompanied him during part of his inspection.

A. McPhail, D.Sc., has been appointed professor of general engineering, and W. O. Tague, lecturer in mechanical engineering, at the Toronto School of Mines. Mr. McPhail is a graduate of McGill University, and has recently been engaged in large engineering works in the vicinity of Boston. Mr. Tague is a graduate of the Massachusetts Institute of Technology, and has been employed by the New York Shipbuilding Company and the Fore River Shipbuilding Company of Quincy, Mass.

H. A. Guess, a graduate of Queen's University, has been appointed chemist to the Consolidated Copper Co., Canea, Sonora, Mexico, the fourth largest copper producing organization in the world. Mr. Guess previously held a position at Silverton, Colorado, and has also had experience in British Columbia and Ontario.

Mr. J. Walter Wells, late of the Belleville assay office, has been in Manitoba investigating the cement-making material of that province. This has involved the examination of many deposits of limestone, shale and clay.

Alexander K. Kirkpatrick has been appointed to the chair of civil engineering in the School of Mines in Kingston, Ont.

G. H. Barnhart has resigned the management of the Ymir mine, and will give his personal attention to the Porto Rico mine. He is succeeded by S. J. Speak, of London.

Mining Share Market.

There has been but little movement during the month, and the amount of stock that has changed hands, both here and in the West, is comparatively small.

The chief transactions were in Canadian Gold Fields Syndicate, Payne, White Bear and Granby Consolidated ; the former stock is firm

and the price has advanced on reports from the St. Eugene mine and the rumor that a dividend may be expected on the latter before a great while.

The demand for White Bear appears to come from those interested in the company, and as the amount of stock offered is limited the sales have not been large.

A considerable amount of Granby Consolidated sold at about three dollars per share, and it would appear that since the control has passed into American hands the Canadian interest is being sold, and the Boston market is taking the stock.

The Iron and Steel stocks have been fairly active, with prices ranging higher, due apparently to the improved trade outlook in the States, and in sympathy with the bull speculation in the steel stocks in that country.

The fixed dividend paying preferred stocks maintain a steady price, and are mostly absorbed by investors, but the common stocks are largely in the hands of the speculating public, and their price reflects more the market conditions than intrinsic value. Nova Scotia Steel and Coal Co. has been traded in at prices ranging from about 61 to 67, and the Dominion Iron and Steel securities have somewhat enhanced in value; during the earlier part of the month a large amount of the bonds were taken off the "street," and there are comparatively few offering at present.

The following list shows the quotations (bid and asked) which have been made during the month ended Saturday, September 28th, as supplied to the Review by **Robert Meredith & Co., 57 St. Francois Xavier Street, Montreal :—**

Par value of Shares.		Asked.	Bid.
.10	Canadian Gold Fields Syndicate.....	.05	.04½
5.00	Cariboo Hydraulic	.75	—
1.00	Centre Star	.25½	.24
1.00	Deer Trail Consolidated	.02	—
1.00	Giant	.03½	.01
10.00	Granby Consolidated	3.00	2.87½
10.00	Montreal and Boston	—	—
1.00	North Star	.02	—
1.00	Payne	.04	.03½
1.00	Rambler Cariboo	.18½	.17
1.00	Republic	.03½	—
1.00	St. Eugene	.45	.40
1.00	War Eagle	.12	.11
1.00	White Bear	.04¾	.04¼
100.00	Nova Scotia Steel (common)	.65¾	.65½
100.00	Ditto ditto (preferred)	—	—
100.00	Dominion Coal (common)	.58½	.58
100.00	Ditto ditto (preferred)	1.12	1.09
100.00	Dominion Iron and Steel (common)..	.12	.11¾
100.00	Ditto ditto ditto (preferred) ..	.39	.38
—	Ditto ditto ditto (bonds)	.73	.73½

CHEMICAL NOTES.

Prof. Park, of Otago University, New Zealand, lays urgent stress on the necessity of fine grinding raw pyritic concentrates before attempting solution of the contained gold either by percolation or agitation; the finer the material the less the time required for high percentage recovery.

A new crucible process for hardening iron is reported from Germany. The carbonizing mixture is made of bone dust, yellow prussiate of potash, phosphorus and cyanide of potassium. The iron and mixture are placed in a crucible with a luted cover, and heated to a bright red heat, after which the iron is taken out and plunged into warm water. The conversion appears to be only skin deep.

At a recent meeting of the Faraday Society, Dr. F. M. Perkins and Mr. W. C. Prebble gave the results of researches to arrive at an electrolytic method of estimating gold, which should be perfectly accurate, and yet far more rapid than the ordinary double cyanide method, which the authors, differing from Classen, consider inordinately long, even in hot solutions. Solutions of sodium thiosulphate, cyanide, sodium sulphide, potassium thiocyanate and ammonium thiocyanate were all tried and the results compared. The first-named was useless; of the others —which are all accurate—the thiocyanates gave the best results and the ammonium salt was better than the potassium. With currents of .2 amperes per sq. dem., the deposition of .05 to .08 gms. of gold was complete in five or six hours. With a current of .4 to .5 amperes, 1.5 to 2 hours sufficed. The presence of a little persulphate considerably reduced the voltage required. Experiments were also made to determine the best method of removing the deposited gold. Chlorine or bromine water was satisfactory, but slow; aqua regia was risky; the authors recommended a 2 per cent. solution of potassium cyanide containing a little hydrogen peroxide or a persulphate. One or two minutes then sufficed to remove the gold.

Stability of Standard Solutions of Potassium Permanganate and Ammonium Oxalate.—"A statement is often found in standard textbooks on analysis that a solution of potassium permanganate gradually becomes weaker on exposure to light, by slow decomposition of the salt; and that it is necessary on this account to re-standardise the solution at frequent intervals. In the course of some recent work involving the use of this reagent we found occasion to doubt the accuracy of this statement, and have, therefore, made experiments extending over a period of twelve months. These have established the fact that, both in the solid state and in solution, pure permanganate retains its strength if kept in well-stoppered bottles, even when exposed to light. On March 30th, 1904, a solution of permanganate prepared from the specially purified salt described in the paper above referred to was made decinormal by weighing, and the accuracy of the solution was confirmed by titration of pure ammonium oxalate and pure ferrous ammonium sulphate. On October 28, 1903, i.e., seven months afterwards, the factor of the solution was found by titration to be 0.997, and on April 15, 1904, the same solution gave precisely the same factor. A similar N|10 solution of permanganate was prepared on October 28, 1903, from the same lot of solid re-crystallised permanganate of potash preserved during the seven months in a closely stoppered bottle. The solid permanganate had attained its original strength, and the second solution re-standardised on April 15, 1904, after an interval of six months, was again found to have the factor 0.997. The above results show that a solution of pure permanganate may be considered to retain its original strength for all practical purposes for at least twelve months, if pure water is used in its preparation and the solution kept in a closely stoppered bottle; and it is not necessary to keep such a solution in the dark."—Journal of the Society of Chemical Industry, June 15, 1904.

INDUSTRIAL NOTES.

The General Electric Company of Schenectady, N.Y., has closed its mica works at Perth and Smith's Falls, and reduced its staff at Ottawa in consequence of dullness in the trade.

The Ontario Pipe Line Co., which has gas wells at Grimsby, has applied for a franchise to enable it to convey natural gas to Hamilton. It proposes to begin laying pipe next spring, and to complete at least ten miles within six months. The rates agreed on between the City Council and the Company under the proposed franchise are as follows: 45c per 1,000 feet for the first five years, 40c for the next ten years, and 38c for the next five years. The rate to manufacturers is to be, for 200,000 cu. ft. a month, 42c; 1,000,000 ft., 40c; 2,000,000 ft., 37½c; 6,000,000 ft., 35c. Cleveland capitalists are largely interested in the company. A Pittsburg syndicate also proposes to enter the field.

A cement factory is to be erected by Messrs. Peter Lyall & Sons at Longue Pointe, near Montreal; a block of land comprising some 300 acres having recently been purchased by the company for this purpose.

A contract was recently closed between the Canadian Northern Railway Company and the Canada Foundry Company for the building of the proposed bridge over the Saskatoon River, north-west of Battleford.

The John MacDougall Caledonian Iron Works Co., Ltd., completed a two-unit Elmore oil concentration plant in August, and shipped it to the Massey mine in Ontario. They have also completed and shipped a large plant for the Consolidated White Bear Mining Company, at Rossland, B.C. The Massey mine plant has an estimated capacity of fifty tons of ore per diem, and is especially designed for the treatment of low-grade copper ores. The makers are manufacturing these concentration plants under a license from the Canada Ore Concentration Company, Ltd. Details of the operation of these plants will be furnished by the Review after each has had several months' operation.

The Aylmer Iron Works Company, Aylmer, Ontario, will increase their capital from $30,000 to $70,000.

The Canadian General Electric Company of Toronto have entered into a contract with the Ontario Power Company, at Niagara Falls, Ont., to supply $2,000,000 worth of machinery, including practically all of the plant for the Ontario company necessary for the transmission of power.

The Pittsburg Coal Company have installed a new clamshell unloader at their dock at Sandwich, Ont.

The corporation known as the Cramp Steel Company has been reorganized under the name of the Northern Iron and Steel Company, Major J. A. Currie being the president, and Mr. Duncan Donald being the secretary. The head office will be in Toronto.

The manufacture of steel rails by the Lake Superior Corporation, at Sault Ste. Marie, Ontario, has commenced, and the Dominion Government have contracted with this company for the supply of 10,000 tons of 80-lb. rails to be used on the Intercolonial Railway.

The Western Engineering and Construction Company propose building a continuous bucket dredge for use on their concessions in the Atlin Country. This dredge, it is estimated, will cost $200,000.

A new factory is building in Ottawa by the Laurentide Mica Company for the manufacture of mica for electrical purposes.

MINING NOTES.

NOVA SCOTIA.

The first blast furnace at North Sydney Mines, Nova Scotia, of the Nova Scotia Steel and Coal Company was blown in in August, and has worked so far very satisfactorily. It has a capacity of 250 tons per diem.

Coal shipments from Nova Scotia up to the first day of August show an increase for some of the shipping companies and a decrease for others. The Nova Scotia Steel and Coal Company increased its output by 27,665 tons, the Inverness Railway and Coal Company by 12,624 tons, the Intercolonial Coal Company by 10,058 ; the Dominion Coal Company decreased 138,938 tons ; the Cumberland Railway and Coal Company decreased its output by 20,511 tons, and the Acadia Coal Company showed a decrease of 5,891 tons.

The August output of the Cumberland Railway and Coal Company amounted to 37,596 tons.

The Dominion Coal Company, Ltd., report the outputs of their various collieries and their shipments for the month of August to be as follows :—

Dominion	No. 1	40,439
"	2	59,107
"	3	29,352
"	4 (Caledonia)	44,016
"	5 (Reserve)	75,435
"	7 (Hub)	20,192
"	8 (International)	23,813
		292,354

Total shipments for month of August, 307,084 tons.

This is an increase of about 13,000 tons over the previous month of July.

The increase over July for Dominion No. 1 was 7,000 tons ; for Dominion No. 2, 12,000 tons ; for Dominion No. 5, 10,000.

The local press have reported a discovery in Cape Breton of a large deposit carrying nickeliferous copper with associated gold and silver ; this report, however, lacks confirmation.

The stock of the Nova Scotia Steel and Coal Company has been subjected to a severe bear attack in the eastern markets during the current month, but has recovered successfully, and is now somewhat in a boom condition. The successful working of the new blast furnace at North Sydney, together with the reported successful financing of the new loan, makes the market position of the company better than it has been for some time past. The directors are to be commended for abstaining from making any official statements which would encourage speculation in the stock, for the uncertain business outlook will prevent any approximation of future estimated profits being reliable.

Rumor has it that the Cape Breton Copper Company is to undergo reorganization, and to suffer a fresh start. There seems no reason, however, to anticipate any greater success in the shape of dividends for shareholders than the past has shown.

It is reported that the entire output of the Dominion Coal Company until the end of 1904 has been sold, and operations are distinctly on the increase. Resumption of work at the Dominion Steel Company has, of course, increased the delivery of coals, and the increase in outside consumption will give the Coal Company a very good ending for the current year.

The shipping pier of the Dominion Coal Company, at Louisburg, has been reconstructed and enlarged. The old pier was a double-decked one, on the upper track of which the coal cars were run by gravity, and the coal was then dumped into chutes leading to the vessels. The cars were dropped to the lower track by a table, and run by gravity to the ground surface, where they were returned to the mines for reloading. The reconstruction has consisted in building large storage bins on shore, from which the coal is conveyed by belt conveyors and discharged at suitable intervals into the chutes leading to the vessels. This new arrangement adds to the capacity of the pier, which retains all its original facilities for transhipping coal direct to the boats. The storage bins, which are built of timber, have an aggregate capacity of 10,000 tons of coal. The coal is discharged from the bins to the belt conveyor, and by it elevated and carried along the pier to be dischargad into the vessels alongside.

The operating power consists of a 125 H.P. engine, which runs the first two sections of the belt conveyor. The power house also contains electrical generators, which furnish the current both for lighting and for driving the electric motor which operates the end section of the conveyor belt. The conveyor belt has a travel of about 700 ft., with a total rise of 70 ft., and is 35 in. in width ; its capacity is from 750 to 800 tons of coal per hour.

The Cape Breton Coal, Iron and Steel Company, Ltd., which is the name of the corporation organized by Mr. Horace Mayhew in conjunction with Coates, Sons & Co., is to proceed at once with the work of developing its coal areas. The management states that it will be a year before the colliery is equipped and producing. The management is as yet undecided whether the shipping point will be at Louisburg or at Sydney. This company, it will be remembered, controls the eastern areas formerly held under option by Mr. Mosely, as well as the western areas.

QUEBEC.

Work at the several asbestos mines in Quebec is being energetically carried on. There is a general scarcity of labor, both at Thetford and Black Lake, which in several instances is hampering operations. The output of the different grades of crude and fiberized asbestos at the older established mines will be quite up to that of 1903.

At Black Lake the mills of the Standard Asbestos Co., Johnsons' Co., and the Union Mines are in regular operation ; in addition, the pits of the Manhattan Asbestos Co. are being operated, and some crude asbestos is being mined ; their mill has not been operated this season.

The pits of the Glasgow and Montreal Asbestos Co. are being opened up. This property has been idle since the winter of 1902. It has lately been leased on a royalty basis by a Mr. Robert Stather, and the work now being carried on is under his direction.

Some parties from Syracuse, New York, have acquired the property of Dr. James Reed (Lot 29, Range A), and some work is being done there. It is the intention of these gentlemen to equip the property with a complete milling plant. The property is at present equipped with boilers, compressor and hoisting plant.

The most important development in the local asbestos business is the construction of the new plant of the American Asbestos Co. on the H. H. Murphy property (Lot 32, Range B.). The milling plant is placed near the main line of the Quebec Central Railway, a short distance north of the Black Lake station. The plant is housed in buildings of a most substantial construction, consisting of main mill buildings, crusher and dryer building, and a storehouse. There is a commodious machine shop, equipped with fine tools. The mill proper is laid out on somewhat different lines to those in operation on other properties ; the chief point of difference is in the method of grinding the rock after it has been crushed by the rock breaker. A rotary crusher, of the well-known Sturtevant mill type, is used in place of a "Cyclone Pulverizer." It is claimed for this machine that it does not damage the fibre to the same extent as the older method, and that the crushing is done with a much less expenditure of power than is required for the cyclone mill. The plant is about ready to run, and the results are being looked forward to with considerable interest by all interested in the industry.

It was the intention of the American Asbestos Company to take power from the St. Francis Hydraulic Co., but the unfortunate bursting of their dam made it necessary for the American company to put in its own steam plant and generator to furnish power to its motors. The mill is connected with the pits by a narrow gauge railroad, the rock and waste being moved by a locmotive. Several comfortable cottages have been erected for the workmen, close to the works.

At East Broughton, the Broughton Asbestos Company have rebuilt their mill, which was destroyed by fire last November. The new mill is of greater capacity than the one destroyed, and has been in operation since July ; it is turning out a fine grade of fibre.

The Quebec Asbestos Company now has its plant in operation. This company began producing fibre at the end of July. At this mine the rock is raised from the pits by means of a cableway with 700 ft. span. The rock-breaker and dryer is near the heading of the derrick. The rock is conveyed from the dryer to the top of the mill by a 16 in. conveyor. Mill and dryer are about 100 ft. apart. The crushing machinery consists of Blake crusher, rotary crusher, and Cyclone mills. The mill is driven by a 16 in. x 36 in. Jenckes-Corliss engine ; crushers and dryer by a separate engine ; power is supplied by two 100 H.P. horizontal tubular boilers. This property was formerly known as the "Walsh-Mulvena" mine, and was last operated about twelve years ago ; the present plant was installed during the spring of

this year. The company is composed entirely of Sherbrooke parties. The rock from this and the Broughton property is of a very fibrous nature. Nearly all the rock taken from the pits goes direct to the mills, and yields a very good fibre.

The Black Lake Chrome and Asbestos Co. are operating two mills at Black Lake, and the output of chrome concentrates is steadily increasing. There is very little doing at any of the other Chrome properties, the price of Chrome iron ore being, perhaps, responsible for this. Neither the mill of the Montreal Chrome Co., nor that of Beebe Bros., at Lake St. Francis, is being operated.

There is every hope that the effort to establish a custom smelter, for the smelting of copper ores at Sherbrooke, will be successful. Negotiations to this end are under way, with fair chances of success. Those interested have decided not to apply to the City Council for a bonus. It is the opinion, generally expressed, that such a smelter would be successful, and go far to aid the development of the many promising copper properties of the Townships.

ONTARIO.

Natural gas has been struck about two miles from Owen Sound, where the Grey and Bruce Co. were drilling for oil, and at Rymal Station, seven miles from Hamilton, where drilling was being done for water.

A strike of oil is reported at Melrose, about twelve miles east of Belleville, Ont.

A great impetus has been given to the oil industry at Petrolia by discoveries recently made in territory which was considered of little or no account in the early days of oil development. Recently the Petrolia Torpedo Co. struck a well yielding 100 barrels a day, a couple of miles south of what was supposed to be the limit of the oil pool, and about the same time J. D. Noble & Son struck a 40-barrel well half a mile further north. Drillings had previously been made in the vicinity without success. The general run of the new wells is from 10 to 15 barrels a day, though the Canadian Oil Fields, Ltd., struck ore yielding from 30 to 40 barrels.

The International Nickel Co., operating in Canada as the Canadian Copper Co., has secured a contract with the Japanese Government for all the nickel required by Japan. The new works at Copper Cliff have commenced operations with a capacity of 1,000 tons a day. About $1,000,000 has been spent in improvements, which, without adding materially to the cost of operation, will double the capacity of the old plant.

The courts have been applied to on account of Alexander Quigley, of Sault Ste. Marie, for a winding-up order against the Rock Lake Mining Co., Ltd., which owns some copper properties near Bruce Mines. It is alleged that the company has liabilities amounting to $200,000, which exceeds the value of the assets, including mine and plant. Among the creditors are the Ontario Powder Co., Carney & Stoen, the Wellman-Seaver-Morgan Co., and Quigley, who holds a judgment for $400. The company was incorporated in 1899 with a capital of $3,000,000, the directors all being residents of the United States. The application was granted, but not to take effect until a report had been received on an option which certain parties had secured for the purchase of the property. A. E. Plummer, of Sault Ste. Marie, was appointed provisional liquidator if the order issues.

New development work at the Sultana mine, Lake of the Woods, has revealed fresh ore bodies. At the eighth level quartz has been found as rich as in the former workings. It was cut in the winze, but the dip seemed to indicate that it would extend to the shaft at a lower level. Active work is now going on at the mine.

A report which has been in circulation in the papers to the effect that tin has been discovered in Eastern Manitoba, south of Cross Lake, and close to the boundary line of Ontario, is not correct. Tests made by the Ontario Bureau of Mines fail to reveal any sign of tin. Such a discovery would be very valuable, but tin has yet to be discovered in Canada in any quantity.

Three of the miners who made the murderous attack on Wm. Welsh, engineer, at the works of the Canada Corundum Company, Craigmont, referred to in the last issue of the Review, are in jail at Pembroke awaiting trial. Only Welsh's splendid physique and temperate habits prevented the charge being that of murder. Welsh was badly cut up, and has not yet quite recovered from the effects of the attack.

Authority has been given to the Giant Gold Co., Limited, to hold its meetings without the Province of Ontario.

The following mining leases heretofore granted in the Province of Ontario have been cancelled : Dr. R. B. Patty, B. Kelly, John Mode, and H. Token, for the south part of Lot No. 3 in Concession A of the Township of Hains, in the District of Nipissing, 80 acres ; Charles Stewart, District of Algoma, for the south half of Lot No. 8, in the Third Concession of the Township of Aberdeen, District of Algoma, 161 acres ; Walter Thomas Ward, of Marquette, Michigan, for the south-east quarter of Section 26 in the Township of Shedden, District of Algoma, 160 acres.

Toronto interests will control the Northern Iron and Steel Co., which is the name of the reconstructed Cramp Steel Co.

W. P. Bullard is responsible for the statement that petroleum in quantity has been found on Manitoulin Island. Four holes have been drilled in the Indian reserve at the eastern end of the island to depths of about 400 feet. Three of these will have to be pumped, but the fourth (which has not yet been shot) promises to be a gusher.

The Tip-Top mine, on Round Lake, is a copper-gold proposition. The return from 23 tons shipped to New York for a smelting test gave $550, or nearly $24 per ton. After paying freight, smelting charges, etc., the net returns were $13.44, which is very satisfactory.

The Tip-Top is one of the properties in which the late James Hammond was interested.

The first indication of a result from the recent trip of the Dominion Commission to investigate the electric smelting of iron ores appears in paragraphs from Ottawa, which announce that Mons. P. Heroult, of La Praz, France, has been in the Ottawa district looking at the iron ores of the section in respect to their availability for conversion by the electric process. This is probably inspired by the gentleman who controls, through option, the properties near the Chat Rapids, and who has been actively engaged in an endeavor to obtain the necessary capital for their development. The Review trusts he may meet with success, not alone in finding his capital, but in obtaining a market for his finished product.

The current press reports an alleged discovery of coal in Eastern Ontario, in Melancthon ; the quality is reported to be anthracite, but the item lacks confirmation.

At the Massey Station copper mine five levels have been run, and a large quantity of low grade ore has been found. At the Hermina mine a shaft has been sunk to 140 ft. depth on a narrow but somewhat rich vein of copper ore.

The Shakspere gold mine near Webbwood is being rapidly opened up, and the ore pans gold freely, even where no free gold is visible. A paragraph on the late disastrous accident at this Shakspere mine will be found in another portion of this issue.

A paragraph is going the rounds of the Toronto press to the effect that Location A.L. 282 in Western Ontario has turned out a brick valued at $8,000 from a thirty days' mill run. If this output can be maintained for twelve months, Location A.L. 282 will be a mine. It belongs to the N.Y. and Ontario Mining Co.

The Steele mine at Sturgeon Lake has about completed its ten-stamp mill, which it expects to have in operation on the 1st of October. Results from this Sturgeon Lake district will be awaited with interest, as the district during the first two years has had a very large local newspaper boom. The auriferous belt from which the gold is obtained has been cross-cutted by an open cut, and a shaft has also been sunk to a short distance. The most of the gold contained is free and visible.

Much interest is shown in the iron deposits of Loon Lake, in the Township of McTavish, Western Ontario. Some two years ago these deposits were examined in the interests of United States iron men, and were declined, chiefly on the ground that their quality was not particularly good, and also on account of a suspicion that the deposits might not continue to any depth. The grade of the best bulk samples thus far seems to run from 52 to 56 per cent. metallic iron, with a large amount of silica, but reports say that the recent diamond drill tests have shown that the grade of the ore is higher with depth, and that the silica disappears. The deposits are only about fifteen to eighteen miles distant from Lake Superior, and shipment to lake ports would be an easy matter if the quality justified such shipments.

A thirty days' mill run at the Sunbeam gold mine, on the Canadian Northern Railway, near Port Arthur, produced a gold brick valued at $8,000. The shaft is now down over 300 feet. A new engine-house has been built.

BRITISH COLUMBIA NOTES.

On the first of the month word was given out that a complete reorganization of the Le Roi mine was to take place at once. Mr. A. J. McMillan, the managing director, becomes general manager ; Mr. J. W. Astley, general superintendent ; Mr. A. I. Goodel, manager of the smelter ; Mr. W. S. Rugh, manager of the mine, and Mr. Jas. H. Treverrow, mine superintendent. Mr. John H. MacKenzie has not yet submitted his report on concentration experiments.

The foreign shipments of coal from Nanaimo for August amounted to 15,627 tons.

The shipment of concentrates from the St. Eugene mill during August amounted to 1,800 tons.

The North Star mine at Kimberley, B.C., reported early in the month the finding of a new body of ore; if the news is confirmed by further exploration, the winding up of the company may be deferred.

The Vancouver Island Development and Exploration Company are making steady shipments to the furnace at Ladysmith. The ore continues to carry high values.

Mr. Constant Fernau has returned to the Kootenays from England, and has announced that he is prepared to at once proceed with the construction of a zinc enriching plant at Roseberry, Slocan District, and of a smelter at Fernie, East Kootenay. The enriching plant will take the zinc concentrates from the Slocan mills, and treat them so as to take out most of the lead ore and silica which the ordinary concentrating mill leaves with the zinc blende, thereby producing a concentrate high in zinc and low in lead and silica. From this enriching (or re-concentrating mill the product will go to the furnace at Fernie, which place is selected on account of its proximity to the coal fields. Cheap coal is necessary to produce the gas, which is an essential feature of Mr. Fernau's process for the recovery of zinc from its ores.

The Slocan Star mine has paid its tenth dividend, amounting to $25,000. The total dividends paid to shareholders now aggregate $557,000. The stamp mill is turning out daily twelve tons of silver-lead concentrates, and about twenty-six tons of clean lump ore. The zinc concentrates, which are a by-product, are stacked at present, needing a further concentration before they are saleable.

The O.K. stamp mill at Rossland is now treating twenty-five tons daily from the I.X.L. gold mine, which has been leased by Mr. Jacob Loff.

The Helen mine, Greenwood Camp, is now shipping high grade ore. The vein averages about ten inches in width, and shipments run over $100 per ton in gold and silver.

The Montreal and Boston smelter at Boundary Falls has been receiving coke in preparation for a start, and has had a force of men preparing ore bunkers for both the Rawhide and Brooklyn mines.

The new company which has taken over the old Dundee mine has been incorporated under the name of Dundee Gold Mines Limited, with a capital of $625,000, in 25c shares. The officers are E. B. Morgan, Vancouver, president; John Hendry, Vancouver, vice-president; the remaining directors are Sir Chas. Hibbert Tupper, F. J. Walker, and C. J. Major.

The Cascade Copper Mining Company have made a profitable shipment of ore to the Tacoma smelter. After deducting all costs and charges, the sum of $22.40 per ton was realized. Periodical shipments are to be made from this date on.

The Joe-Joe mine, near Bear Lake, in the Slocan District, has made discovery of some remarkably rich gold ore, which also carried native silver. The mine is in the Three Forks belt, where galena from the McAllister mine is known to carry a high value in gold. The ore is in a narrow streak of about four inches in width.

During the year ending June 30, 1904, the Ymir mine, usually known as a gold mine, produced 2,195 tons of lead ore, containing 667,615 lbs. of metallic lead.

The Nicola, Kamloops and Similkameen Coal and Railway Company have procured a charter to build a railway from Spence's Bridge through the Nicola and Similkameen valleys to Osoyoos; at least, this is the announcement publicly made by Mr. George A. Begy, of St. Catharines. Mr. Begy, accompanied by Col. W. H. Merritt, of Toronto, completed a trip of inspection over the proposed line early this month. Mr. Begy is the president of the road named, and is authority for the announcement that all arrangements for financing the line have been made, and that Mr. Chas. H. Keffer, C.E., has nearly completed the necessary surveys. The first part of the mine to be constructed will be the forty-five miles from Spence's Bridge, on the C.P.R. to the coal deposits near Nicola.

The tunnel of the Consolidated Cariboo Hydraulic Company at Bullion, B.C., is making very satisfactory progress, being in now about 300 feet.

From the approximate returns compiled by the Provincial Mineralogist for the first six months of 1904 we give the following:—

	Jan. 1 to June 30, 1904.	Year 1903.
Gold	123,339 ozs.	232,831 ozs.
Silver	2,037,061 ozs.	2,996,201 ozs.
Copper	17,513,886 lbs.	34,359,921 lbs.
Lead	16,500,000 lbs.	18,089,283 lbs.

The above figures clearly show the stimulus given to silver-lead mines by the Government bounty; they also show the lower grade of ore which has been mined.

The forest fires have temporarily put Camborne Camp out of business by the destruction of terminals and damage to tramways and mills. A heavy fall of rain checked the danger, but protracted rains are needed to quench all danger.

The erection of the 30-stamp, 100-ton mill at the White Bear mine, and the liabilities incurred for the Elmore plant, not yet completed, have compelled the directors of the company to offer 40,000 shares of the stock to shareholders to provide ready money for pressing payments.

The Centre Star mine increased its weekly outputs during September by about 1,000 tons.

The Societe Miniere de la Columbie Britannique reports a favorable season's work on Boulder Creek, and the certainty of a dividend for this year.

The gold recovered by the Otter Creek Hydraulic Company this season has been very coarse and much worn.

A good strike of pay dirt is reported from Ruby Creek at a depth of 47 feet, where bedrock was encountered. At a depth of 23 feet the gravel averaged $1.00 per yard. A nugget weighing 18 ozs. 5 dwts. was taken from 86 below on Spruce Creek on September 2nd.

It is reported, on good authority, that the Kootenay Valley Land Co., a London company, which some years ago acquired the extensive holdings of Mr. Grohman in East Kootenay, have, in conjunction with the C.P.R., successfully financed the construction of the Kootenay Central Railway, which is to run from Golden to Fort Steele, and thence to a junction with the Crow's Nest Railway near Elko. This will be good news to the owners of mineral claims along the Columbia and Kootenay Valleys, and will give a fillip to development in the Fort Steele and Windermere districts. The Estella and the Paradise mines are ready to ship considerable quantities of ore, and many promising prospects in the neighborhood of Wasa, and on Toby Creek, will have inducement for development.

YUKON.

The stampede to Tanana has seriously curtailed the supply of labor for the Klondike District during this season. At no time since the summer of 1897 has there been such a scarcity of men, and in consequence wages have advanced from 25 to 30 per cent. It is feared that winter operations will be much diminished in consequence.

Advices from Dawson state that the Government waggon road up Sixty Mile Creek has been completed for a distance of forty-two miles, leaving but sixteen miles to the terminal. Matters on Glacier and Miller Creeks are reported as prosperous, there being from 125 to 150 men employed outside of the force used by the N.A.T. & T. Co. on its concession. The company are putting in a reservoir at 16 below, on Miller, and at this point the hydraulic plant of the company is situated. The reservoir gives an effective head of 420 feet.

The day of the individual miner is slowly but surely passing, and the era of large companies, well financed, has begun. Ex-Mayor McLennan, of Dawson, is authority for the statement that the bulk of the output is now made by the big companies.

According to the figures of the territorial comptroller the shipments of gold from Dawson this year have been as follows:—

January	85,895.55
February	107,417.10
March	138,740.40
April	60.00
May	840,032.10
June	2,709,339.20
July	1,300,250.55
A total of	5,181,734.90

for the first seven months of the year.

Mr. W. M. Brewer, of Vancouver, who has been in the northern country for some months, is reported as saying that since July there has been little doing in the new gold fields to the west of White Horse but stampeding and staking. From information received, he is inclined to believe the area covered by the new diggings will approximate 100 miles square. Time and systematic development are needed to determine the future of the districts staked, which are principally the Alsek, the Kaskawulsh, and Kluane Lake.

The Alaska gold output for the fiscal year ending June 30th, 1904, according to the Department of Commerce and Labor, amounted to $6,328,524, while in the fiscal year 1903 Alaska shipped to the United States gold ore and bullion to the value of $4,754,578. These figures refer only to Alaskan gold, however. The same statistics noted an even larger quantity of Canadian gold shipped to the United States through Alaska, though less than during the preceding year. In 1903 the aggregate shipment of Canadian gold to the United States through Alaska amounted to $10,979,285, while during the year just closed the Canadian shipment aggregated $8,555,600.

A landslide on Flat Creek in the early days of August revealed good pay gravel, and the slide was at once followed by a mad scramble to the Dawson office by locators. The gravel is reported as yielding from 2 ozs. to 30 ozs. to the pan.

The successful operations of the Alaska Coal and Petroleum Company near Dyak Bay is once more directing attention to the coal deposits of the Pacific Coast. It is known in mining circles that the collieries now operating on Vancouver Island have a limited life, and this fact invests with importance every move made for the purpose of securing future supplies. A special report has been made for a London firm on the Graham Island deposits. High-class bituminous and at least one workable seam of anthracite coal have been located. The principal hindrance to development has been the necessity for building a railway to the coal camp, a distance of thirty miles.

COAL NOTES.

Mr. P. Burns, of Calgary, the well-known wholesale butcher of Calgary, who supplies the Kootenays with beef, has acquired some 16,000 acres of what is supposed to be anthracite coal, located in the Misty Range, forty-six miles west of Okotoks, Alberta. Reports from Toronto lead to the belief that Mr. Burns is endeavoring to form a Toronto company for the exploitation of his purchase. Mr. Burns is reported to ask the sum of $320,000 for the option now held by him.

In reply to Trade and Labor communications received from Guelph and Toronto, the Ontario Commissioner of Crown Lands has stated that his Government last year sent out a special exploring party through various sections of Northern Ontario where coal was believed to exist, but that results were not definite.

For the fiscal year ended June 30th, 1904, there were imported into Canada from the United States 4,434,762 tons of bituminous and 2,022,810 tons of anthracite coal, a total of 6,457,572 tons. This amount is 1,472,148 tons in excess of similar imports for 1903. The increase in bituminous coal amounted to nearly 20 per cent., and in anthracite to nearly 55 per cent.

The exports of Canadian coal to the United States for the same fiscal year amounted to 1,317,979 tons, or but 20 per cent. of the amount imported. In short, Canada imported five tons of coal for each ton exported.

The average number of men employed in the Crow's Nest Pass coal fields exceeds 2,000.

The report of the Royal Coal Supplies Commission of Great Britain already fills three large volumes which deal with : The limit of depth in working, the minimum thickness of workable seams, and the waste in working. The limit of depth to which coal mines may be worked in England has been given careful attention, and much testimony was submitted. The rate of increase in temperature varied in different parts of the island, ranging from an increase of one degree for every 40 feet in Lancashire to one degree for every 108 feet in South Wales. According to some of the testimony presented, the temperature will average 98 deg. Fahr. at a vertical depth of 4,000 feet, and this temperature would limit further working.

Foreign exchanges say, that the Coal Trust of Germany, the Rhenish Westphalian combination, are selling coal in Havre (France) for $3.45 per ton, against English coal at $3.83 per ton, and that, in consequence, British sales have decreased by over 400,000 tons. The railways of France, which are owned by the State, are now burning German coal from the Ruhr district, which is delivered at Palisse for $4.44 per ton.

Extensive prospecting and development work on the coal seams of Controller Bay, Alaska, is doing by the Alaska Development Company, which is an English corporation. Controller Bay is near the mouth of the Copper River in American territory. The country is rough and broken, but presents parallel outcroppings of coal seams varying from 4 ft. to 35 ft. in thickness. Discoveries of petroleum are also reported to have been made, and another English company, known as the Alaska Petroleum and Coal Company, has about a dozen men at work with a boring machine.

The coal opened along the Yukon River, at Cliff Creek and Coal Creek, has found a small market this season at prices averaging about $12 per ton. It is a lignite occurring in comparatively thin seams, and will find no ready market where oil or the British Columbian coals can be obtained.

The United States Government statistics of the production of coal in that country for the calendar year of 1903 show the following figures :— Bituminous, 285,107,392 tons ; anthracite, 74,313,919 tons ; a grand total of 359,421,311 tons. These figures show the marvellous growth of consumption during the last ten years, for in 1893 the total production was less than 200,000,000 tons.

The large growth of the coal mining business in the interior of British Columbia is shown by the fact that in 1898 there were but 8,986 tons of coal and 361 tons of coke produced in the Crow's Nest Pass region, whereas in 1903 over 660,000 tons of coal and 167,700 tons of coke were mined and made in the same region.

The Review is informed that the object in consolidating the Dunsmuir coal interests with those of the Western Fuel Company was the effecting of a saving in the cost of producing and shipping British Columbia coals to the California market. A reduction of costs meant a lower selling price, which was necessary in order to counteract the reduced market due to sales of oil and gas as fuel in California. The Western Fuel Co. are to keep four vessels in constant commission between the mines and San Francisco.

The Dominion Coal Company has made a trial shipment to Mexico of 5,000 tons of coal. The Elder-Dempster SS. "Degama" took the cargo to Vera Cruz consigned to the Inter-Oceanic Railway, which runs from Vera Cruz to the city of Mexico. Should the shipment prove acceptable, a new and growing market will be opened to the Dominion Coal Company.

NOVA SCOTIA COAL SHIPMENTS.

Company.	August. 1903.	August. 1904.	Eight Months. 1903.	Eight Months. 1904.
Dominion Coal Co.	225,786	307,084	1,878,111	1,820,471
Nova Scotia S. & C. Co.	49,954	54,256	274,526	301,493
Cumberland Ry. & C. Co.....	31,666	37,596	292,908	278,533
Acadia Coal Co.....	25,831	23,708	225,254	167,240
Intercolonial Coal Co.	19,918	22,713	152,237	165,090
Inverness Ry. & Coal Co.....	12,741	18,321	88,540	106,744

The Dominion Coal Company is preparing for an increase in its St. Lawrence River trade, and has ordered three new coal boats to be delivered in May, 1905. The order was given to a Norwegian shipbuilding firm.

Digest of Recent Patents; Mining and Metallurgical.

Aug. 23, 1904.

768,054—Electric-Furnace. Carl G. P. de Laval, Stockholm, Sweden. An electric-furnace chamber having a horizontal feed-opening, an escape-opening and a focus of electric heat within said chamber, and opposite said feed-opening ; the said escape-opening being located above said feed-opening and between said feed-opening and said focus.

768,108—Sulphuric Acid Plant. Adolf Zanner, Brussels, Belgium. A plant for the manufacture of sulphuric acid, comprising a roasting-furnace, a Glover tower, a heating-flue for the passage of the sulphur fumes and gases from the furnace to the tower, and vessels for the concentration of sulphuric acid located within said flue and adapted to be inserted and withdrawn therefrom, said vessels being provided with an inlet or supply pipe extending through the wall of the flue so as to receive its supply from without, and a discharge-pipe likewise extending through the wall of the flue, and vapor-exit openings discharging into the flue, the inlet or supply pipe being located at the end proximate to the tower, and the discharge-pipe being located at the end proximate to the furnaces.

Sept. 13, 1904.

769,936—Process of Extracting Precious Metals from Ores or Slimes. Henry R. Cassel, New York, N.Y. The process of extracting precious metals from ores, which consists in adding a bromide and a cyanide in solution to the ore, then passing chlorine gas through the mixture to convert the bromide into bromine and form solvents for the precious metals, and reconverting the bromine into bromide.

769,689—Rabble for Roasting-Furnace. Michael Corcoran, Anaconda, Mont. A device having a supporting structure and a blade, one of said members being provided with a longitudinally-tapering guide, and the other said member being provided with a correspondingly-tapering head interfitting in said guide.

768,035—Extracting Zinc or other Sulfids from their Ores. Guillaume D. Delprat, Broken Hill, New South Wales, Australia. A method of separating ores from the gangue, which consists in forming an aqueous solution of an acid capable of reacting with the ore to form a gas and increasing the density of said solution by adding thereto a suitable substance, then feeding the mixture of ore and gangue to the solution, decreasing the density of the gas as it is formed on the ore particles, and removing the ore particles raised to the surface.

Aug. 30, 1904.

768,774—Construction of Frozen Walls for Shafts in Mines. Karl Schmidt, Erkelenz, Germany. Improved means for forming frozen walls for shafts embracing a plurality of groups of connected freezing-tubes, and a freezing medium conveyed through said groups.

768,748—Roasting-Furnace. Ottokar Hofmann, Argentine, Kans., assignor to The United Zinc and Chemical Company, Kansas City, Mo., a corporation of New Jersey. The combination of a series of shelves or roasting-hearths, a vertical hollow shaft, hollow stirring-arms connected to said shaft, a vertical air-pipe centrally located in said shaft, and branch air-pipes located in said stirring-arms, said hollow shaft having openings at top and bottom to provide for a draft there-through, and said branch air-pipes being arranged to discharge into the outer ends of said stirring-arms, the air so discharged passing through the stirring-arms to the vertical-hollow shaft.

768,976—Conveyer. Isaac Christ, Tamaqua, Pa. A conveyer comprising slotted chain-links and slotted flight-links, and double-headed pins pivotally connecting the ends of the chain-links and also supporting and locking the flight-links in position, all of said links having their slots formed with enlargements to permit the passage of the heads of said pins, the flight-links corresponding in length with the chain-links and supported against the sides thereof by said pins.

768,858—Charging Apparatus for Blast Furnaces. Walter Kennedy, Allegheny, Pa. A blast-furnace plant having in combination a skipway, a skip movable along such a way, a storage-bin arranged above the skipway at the skip-loading point, a line of track extending from the ore pile to a point above the storage-bin, and cars movable along such track.

Sept. 6, 1904.

769,280—Process of Extracting Gold from Ores, etc. Herbert S. Stark, Johannesburg, Transvaal. The process of extracting metallic gold from acid pyritic auriferous ores, consisting in treating the crushed ore with a solution of sulfocyanid of an alkali metal, in the presence of an oxidizing agent, including atmospheric oxygen, whereby the gold is dissolved out by the nascent cyanogen and hydrocyanic acid, produced in the presence of the acid in such ore by the mutual reaction of the sulfocyanid and oxidizing agent; and afterwards separating the gold from the solution thus formed.

769,489—Placer-Mining Machine. Nathaniel W. Pulsifer, Philadelphia, Pa. A hopper supported in an elevated position by suitable framework, an inclined grizzly leading therefrom, in position to receive material discharging from the hopper, a chute into which the grizzly discharges, a series of conical-shaped screens suitably mounted to receive materials from the chute, an extended assorting-table suitably positioned with relation to the screens, lateral chutes steeply inclined, having their upper ends adapted to receive material from the screens, and having their lower ends oppositely curved and downwardly curved, with the discharge ends extending in a direction parallel with the assorting table, and adapted to spread the material thereover by impetus.

769,431—Ore Concentrator. Ira A. Cammett and Frank E. Shepard, Denver, Colo., assignor to Arthur R. Wilfley, Denver, Colo. The combination in a concentrator-table, the riffles, and the separating-pieces forming the table-surface and between which the riffles are placed, the said riffles lying between and projecting above the separating-pieces for a portion only of their length, and merging into and continuously between the said separating-pieces toward the tail end.

769,461—Mining Machinery. Erastus S. Bennet, New York, N.Y. The combination with a car-body, a vertically-movable rack-bar arranged to one side of the same, and working in a support connected with the car-body, a gear-wheel meshing with the rack-bar, a worm-wheel on the shaft of the gear-wheel and a vertically-extending shaft and worm thereon meshing with the worm-wheel and means for operating the vertically-extending shaft.

769,231—Ore Concentrator. George E. Perkins, Providence, R.I. A device comprising a concentrating-table, a distributing-trough arranged near one side thereof, and having perforations in its outer side, said trough being elevated whereby middlings may be passed thereunder, a second trough elevated above the plane of said discharge-trough and terminating at a point beyond the outer side of the latter and nearer the concentrate discharge than the initial pulp-feed, means for collecting the middlings from said table and delivering them to said elevated trough, and means for supplying water to said distributing-trough.

770,155—Conveyer. Henry H. Bighouse, Canton, Ohio, assignor to the Sultman Company, Canton, Ohio, a corporation of Ohio. The combination of a delivering-conveyer, a receiving-conveyer running at an angle thereto and a side guide along the delivering-conveyer extending above its surface, which guide is terminated or partly removed at a point remote from the receiving-conveyer to permit the articles conveyed to extend at an angle to both said conveyers, whereby the forward end of such article is conveyed in one direction by the receiving-conveyer while the rear end of such article is conveyed in another direction by the delivering-conveyer.

769,742—Cement-Kiln. Frank M. Haldeman, Alpena, Mich. A cement-kiln consisting of a kiln portion proper and a hood portion, the kiln portion comprising a casing and a lining of refractory material extending to the lower end of the casing, the hood comprising a casing having a refractory lining, the casing of the hood extending beyond its lining and adapted to telescope on the end of the kiln, and a gasket of non-heat-conducting and non-fusible material interposed between the end of the kiln and its lining and the lining of the hood.

770,111—Apparatus for Charging Blast-Furnaces. Walter R. Reece, Pittsburg, Pa., assignor, by mesne assignments, to Clarence W. Coffman, Pitsburg, Pa. A blast-furnace-charging apparatus comprising a casing having curved walls and two axially-mounted valves movable toward each other, each valve fitting against the said curved walls and having a plurality of pockets, opposite coinciding pockets, a bell beneath said valves, and an actuating-rod therefor, said valves being designed to discharge against the apex of said bell.

NEW COMPANIES.

BRITISH COLUMBIA.

The Northern Gold Mines Co., Limited. Incorporated 17th August, 1904. Capital, $1,500,000.

The Standard Oil Company of British Columbia, Limited. Incorporated 17th August, 1904. Capital, $1,000,000.

The Challenger Mining and Development Company, Appleton, Wisconsin. Licensed in British Columbia, August 28th, 1904. Capital, $24,000.

MANITOBA.

The Williams Quarry Company. Incorporated August, 1904. Capital, $100,000. Provisional directors—A. Davidson, J. Williams and J. Dolmer, Winnipeg, Man.

QUEBEC.

The St. Lawrence Coal Company. Incorporated August, 1904. Capital, $500,000. Provisional directors—James Robinson, G. A. Forbes and Chas. Brandeis, Montreal.

ONTARIO.

The Northern Iron and Steel Company, Limited. Incorporated 14th September, 1904. Capital, $2,500,000. Head office, Toronto. Provisional directors—John Allister Currie, Duncan Donald, Fred Asa Hall, William John Lindsay, Toronto, and John Thomas Duguid, Collingwood Ont.

British Columbia Process Co., Ltd. Incorporated 26th July. Authorized capital, $500,000, in shares of $1.00 each. Head office, Toronto. Provisional directors—A. B. Cook, G. E. Kingsley, C. B. Taylor, R. M. Melville, C. P. Green.

Grand Valley Peat Products, Ltd. Incorporated 26th July. Authorized capital, $200,000, in shares of $50.00 each. Head office, Toronto. Provisional directors—J. C. Steele, W. D. Earngey, W. H. Jackson.

The Trout Creek Development and Mining Co., Ltd. Incorporated 17th August, 1904. Authorized capital, $100,000, in shares of $1.00 each. Head office, Trout Creek, Ont. Provisional directors, Moses Hewitt, Gilbert Trussler, Michael Corkerg, all of Trout Creek.

The Point Pelee Oil and Gas Exploration Co., Ltd. Incorporated 17th August, 1904. Authorized capital, $40,000 in shares of $1.00 each. Head office, Leamington. Provisional directors, Wm. C. Campbell, Andrew W. Palmer, John C. Forster, G. W. Videau, C. J. O'Hara, all of Detroit, Mich.

Mohawk National Gas Co., Ltd. Incorporated 7th Sept., 1904. Capital, $150,000, in shares of $25.00 each. Head office, Brantford, Ont. Provisional directors—Henry Cockshutt, E. L. Cockshutt, Wm. J. Aikins, Frank Cockshutt, Denis A. Coste.

The Eldorado Mining Company, Arizona, has been licensed in Ontario with a capital of $50,000.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills, who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licences to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly, either by arrangement with the owner or by arbitration, all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

PROVINCE OF QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles and the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mining of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals, and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in surveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds: Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P.Q.

Dominion of Canada.

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite Not more than 320 acres can be acquired by one individual or company Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within 15 days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permisson may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location

PLACER MINING

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square ; entry fee $5, renewable yearly On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental $100 per mile for first year and $10 per mile for each subsequent year Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be made within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10 Royalty at the rate of two and one-half per cent on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200

A certificate that work has been done must be obtained each year ; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM

All unappropriated Dominion Lands in Manitoba, the North-west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre subject to royalty at such rate as may be specified by order-in-council

Department of the Interior

OTTAWA. February. 1904

JAMES A. SMART,

Deputy of the Minister of the Interior.

CONTRACTORS TO H. M. GOVERNMENT

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS

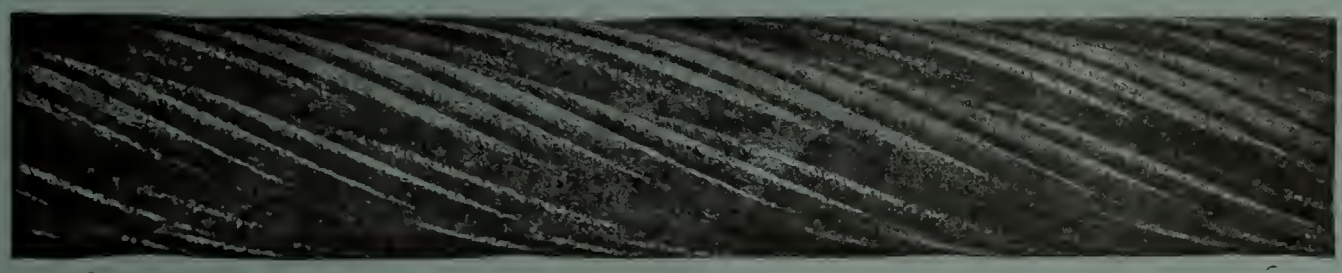
Rutherglen, Glasgow, Scotland

MANUFACTURERS OF

WIRE ROPES for Collieries, Mines, Aerial Tramways

Transmission of Power, Logging and general Hauling and Hoisting Purposes.
Wire specially selected for own exclusive use.
We have made many records with our Winding, Haulage and Crane Ropes.

Illustration of Winding Rope, 240 fms long x 3½ circ. Galvanized Special Improved Patent Steel, Compound Make, supplied to Kenneil Collieries Bo'ness. Scot., which gave a record life of 6 years and months. Shewing condition when taken off.



TELEGRAMS—"Ropery Rutherglen." A B C, A I and Lieber's Codes used.

AGENTS IN CANADA:

Wm. Stairs, Son & Morrow, Ltd., Halifax, N.S.
W. H. Thorne & Co., Ltd., Saint John, N.B.

Drummond, McCall & Co., Montreal
John Burns, Vancouver, B.C.

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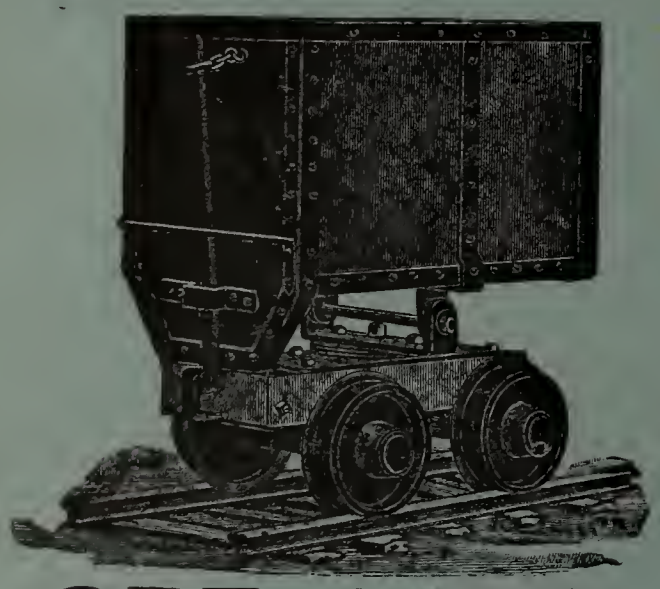

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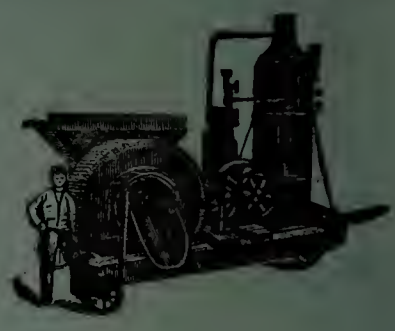

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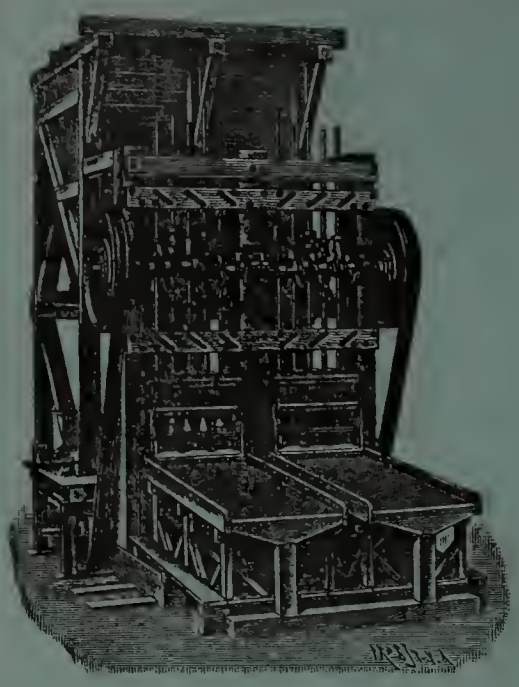

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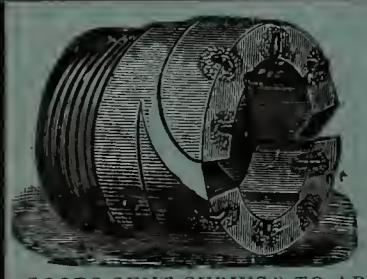

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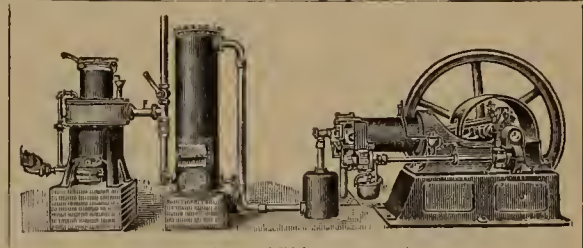

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CONTENTS.

Our article on *Lead in Ontario* in last month's issue has drawn a courteous letter from the mining superintendent of the Ontario Mining and Smelting Company, Mr. H. F. E. Gamm, which we print among our correspondence. Mr. Gamm's letter confirms our opinion in the article mentioned, i.e., that our B. C. friends have no occasion to be disturbed. It also shows that the Bannockburn vein is of a different character to the lead veins previously exploited in Ontario, and, as such, may have a very different history; the freedom from arsenic and antimony is certainly a distinguishing mark from other Hastings County deposits.

The Engineering and Mining Journal of Oct. 13th, published a letter from "Outsider," Spokane, which for candor and truth is commendable. "Outsider" wrote facts which have been well known to residents of Rossland for a year or more. It is well understood that any attempts at the amalgamation of Rossland's big producing mines will have to consider the acquisition of the Snowshoe property in the Boundary country, and no one knows better the comparative present worthlessness of the Snowshoe than the general manager of two of the big mines which are to enter the combine, Mr. E. B. Kirby. The Centre Star and War Eagle properties know well the disadvantage of the Northport smelter for Rossland ores; any consolidation sheme should eliminate the active operation of the Northport plant for the present.

In the REVIEW for August an editorial note promised investigation of the question whether the coals of the Nicola Valley were *true* bituminous or not. We are now in position to say that the matter has been very closely examined into, and, although the printed analyses have shown fixed carbon as high as 58. per cent., the vast majority of them show volatile matter above 37 per cent and fixed carbon below 52 per cent. Our informant is a disinterested geologist who personally designates the coal as "good lignite." In the report of Dr. R. W. Ells, a copy of which has been furnished us by courtesy of Mr. T. J. Smith, of the Diamond Vale Company, the only paragraph relating to the characterization of the coal reads thus :—"The greater part *appears* to be a bituminous coal of good quality," but Dr. Ells saves an authoritative pronouncement in his introductory letter wherein he says "As the specimens have not arrived, I am not able to furnish details of analysis of the coal."

According to the evidence which the REVIEW has submitted, we think our characterization of the coal in our August issue as "of a low bituminous character, just a little removed from lignite" to have been an eminently just and fair one.

Cheticamp (C.B.) Copper.

The Province of Nova Scotia has had several flotations of copper mining industries, none of which have yet been financially profitable, as witness Coxheath, Dorchester and Cape d'Or. There has come to our notice a new concern known as "Cheticamp Copper Company, Ltd.," which deserves mention. The Cheticamp Copper Company is the successor of the Eastern National Copper Company, which was formed in 1902, with a small capital, to prospect the Cheticamp field for commercial copper deposits. This original company expended all its funds in locating and developing, to a limited extent, some 155 mining areas, or about 135 acres, which it acquired from the Government of Nova Scotia under leases running for

eighty years, subject to a royalty of 2 per cent. of the gross value of the product.

Cheticamp lies nearly upon the 61st meridian, and in latitude about 46 deg. 30 min. north. The formation along the coast line belongs to the carboniferous series, but the mountainous character of the country shows rocks (syenite and granite) of pre-Cambrian age on the mountain tops, and the V shaped gorges, often of considerable depths, and due to erosion, reveal strata of schistose character which are probably of later Silurian or early Devonian age. It is in these schists that occur the outcroppings of the copper-bearing rocks. As many of these gorges reach to a depth of 1,000 feet below the mountain tops occasional good geological sections are afforded. The greatest elevation above the sea is about 1,500 feet, and we understand that the outcrops occur at 1,000 to 1,300 feet elevation, bringing them very near the pre-Cambrian granites.

The Schists have been much compressed and altered, and are penetrated by numerous dikes of felsite and igneous rocks. At the base of the Schists the mineralization appears to be chiefly galena, changing as altitude is attained to pyrrhotite, carrying arsenical sulphides, and in the upper layers to pyrite and chalcopyrite, with a little arsenopyrite.

The schistose layer or bed which is working, has little or no gossan, or oxidized outcrop, but is considerably leached of its metallic contents. It has a thickness of about 350 feet, and dips easterly at an angle of about 45 deg. Some 1,100 to 1,200 feet along the strike of these schists (which is approximately N. E. and S. W.) has been exploited by open cuts, and in one place a slope has been put down to a depth of about 100 feet. Assays of material from the open cuts gave an average of 3 per cent. copper; those from the bottom of the slope showed a highest content of 6 per cent. copper. In addition to copper values the sulphides appear to carry from $1 to $3 in gold and silver to the ton. Assays of sample lots of ore sent out from the property have ranged from 2 per cent. to 5 per cent. in copper, or from 40 to 100 lbs. of copper to the ton of ore. On the basis of western rates the copper values would then range from $3.00 to $8.00 per ton.

This company has had the property reported upon by Messrs. J. E. Woodman and F. H. Sexton, professors of geology and mining respectively, at Dalhousie University, N.S., and also by Mr. W. H. Kinnon, late of Denver. While the professional reports are, in a sense, favorable they are not authoritative, neither gentleman being proficient in practical commercial work; they have perhaps measured more ore "in sight" than would be accepted by a conservative engineer. Nevertheless the fact remains that an enormous quantity, in tonnage, of copper bearing rock is probable, though not *technically* in sight.

It seems, to the REVIEW, that the question before the Cheticamp Company is whether a 3 per cent. copper ore in that locality can be made to pay. We trust it can, and that Nova Scotia may be known for its copper production as well as for its coal, iron and gold.

The Dominion Iron and Steel Company.

The fifth annual meeting of the Dominion Iron & Steel Company was held in Montreal on Wednesday the 19th of October.

The President, Mr. J. H. Plummer, presented his report, which the shareholders regarded as very satisfactory.

The financial statement for the year was as follows :—

Dr.

Interest on first mortgage bonds	$395,550.00	
General interest account	131,303.07	
Sinking fund first mortgage bonds	55,799.96	
Dividend on preferred stock, April 1, 1903	87,500.00	
		$670,153.03
Balance of account for coal department, written off		245,467.23
Appropriation for shrinkage in value of materials not chargeable to operating account, 1903, provision for unsettled claims, etc.		123,633.73
		$1,039,253.99

Cr.

Balance brought forward, December 31st, 1902		$309,612.88
Net profits operating account, iron and steel department, 1903	$115,576.87	
Rents received	8,036.86	
Reserve and suspense account, transferred	21,790.27	
		145,404.00
		$455,016.88
Balance at debit carried forward, December 31, 1903		584,237.11
		$1,039,253.99

In speaking to the accounts, the President drew attention to the decline in market value of the products of the company during 1903, and the consequent reduction in assets which the accounts presented. The operating account of the Iron and Steel Department was as follows :—

Net profit on sales	$341,890.07
Shrinkage in value of pig iron, steel, etc.; provision for bad debts, etc.	226,313.20
Net profit in operating account for year	$115,576.87
Earnings, accounted on December 31, 1902	$1,977,328.10
Rental, January 1st to August 31, 1903	1,066,666.67
Interest on special loans for payment of rental	118,100.00
	$3,162,094.77

Speaking of the Coal Department, President Plummer said that the sum of $2,635,000 had been paid over by the Dominion Coal Company on the 17th December, 1903, and that sum had been disposed as follows :—

Received from Coal Department	$ 265,000.00	
Received from Dominion Coal Co.	2,635,000.00	
Receiver for interest	16,627.54	
		2,916,627.54
Balance written off		$ 245,467.23

Mr. Plummer, in the course of his address, and in moving adoption of the report, declared his confidence in the position and future of the company, and his appreciation of the Director of the Works, Mr. Graham Fraser. He declared that Lake Superior ores could be laid down as cheaply at Sydney as at Pittsburgh, and denied all stories of the deterioration of the Wabana ore, of which he declared the company were using ninety-four per cent. in their furnaces.

Mr. Graham Fraser presented his report as Director of the Works. We regret that his report is too lengthy for reproduction in this issue, but its main points were as follows :—

The main source of ore supply is Wabana; this year fully 315,000 tons will be mined, of which 115,000 is contracted to

be delivered in Europe, where it has a ready sale at fair prices; 200,000 tons will be consumed by the furnaces at Sydney. The ore is actually costing less than the original estimate, and the present cost price need not suffer an increase for some years to come.

Mr. Fraser stated the coal requirements to be at the rate of 22,500 tons per stack per month, and that the Dominion coal contained too much sulphur to be coked without washing. The requirements of the furnaces will need an enlargement of the number of coke ovens, which at present are 450 in number.

The four blast furnaces are reported to be in good condition and well equipped, two are now steadily in blast, one making foundry pig and the other basic iron.

Of the ten open-hearth furnaces five are in operation; the other five are being overhauled, and equipped with the additional gas producers which are necessary.

The blooming mill is reported to be ample for the product of all the ten open hearth furnaces, but an enlargement of the present heating furnaces is needed, which is now going forward and will be finished in January, 1905.

The rod mill, completed last April, has shown a capacity greater (by twenty-five per cent.) than it was planned for, and the quality of the rods turned out is very satisfactory.

In reference to the rail mill, Mr. Fraser confined himself to stating its capacity at five hundred tons per diem, and to the fact that the buildings and machinery of the first rail mill would be utilized so far as they would go.

The significant part of Mr. Fraser's report, lies in the statement that "The output of the plant should be manufactured into such products as the Canadian market demands, keeping to the fewest lines which will keep the works running at full capacity." Mr. Fraser believes that the whole of the tonnage of the works can be sold in Canada, since the consumption of the Dominion is now annually over 1,000,000 tons of pig iron, bar iron and steel products.

This is in marked contrast with the declared policy of two years ago when the export portion of the business was looked upon as of much more value than the home market.

The figures and statements produced at this meeting certainly justify a certain amount of optimism among the holders of preferred shares. Time and good markets are both required before the heavy fixed charges (amounting to $750,000.00) can be considered as safely earned, but that the preferred shares have a real value is unquestionable.

Further time must elapse before the common shares can be considered as anything but mere paper.

The Le Roi Merger.

The correctness of our information with reference to the proposed amalgamation of *Le Roi, Centre Star* and *War Eagle* mines and the inclusion in the merger of the *Snowshoe*, is verified by the steps that have been taken since our last issue appeared, to further this project. Prof. W. R. Brock, of the Geological Survey, has been granted special leave of absence to act as valuer in the matter and is now at Rossland. He has already visited the Snowshoe mine in company with Mr. Astley, now manager of the Le Roi and formerly of the Snowshoe, which has been re-opened and cleared up for Prof. Brock's inspection at considerable expense. It is admitted that the intention is to include this mine in the amalgamation. So long as the shareholders of the other properties go into the deal with their eyes open, and are fully acquainted with the facts it will be their own fault it they make a bad bargain. We have every confidence in the ability and integrity of Prof. Brock relied upon to make a fair and competent valuation, but that is not the point; he goes into the transaction with his hands tied. The fact is that Mr. McMillan left London with authority to include the *Snowshoe* in the merger, the only question being one of valuation. Prof. Brock's opinion is not asked as to the *desirability* of this, he is simply told to estimate the ore and its value. Now, much could be said on the position of Mr. Waterlow and Mr. McMillan in this connection; they are the largest shareholders in the Snowshoe, having some $400,000 invested. By mining men in the Kootenays this money is looked upon as lost. Several years' experience of working the mine had been had by these gentlemen, and they know, better than anyone else (except the smelter people), that the ore is highly silicious and very low grade. They know that its smelter value did not average $4.00, and yet they undertake to negotiate for its sale to a company of which they are the chief officers, and on the basis that it will help to solve the "fluxing" problem of ores already so silicious that they require basic flux and not silicious. We prefer to leave this statement of the case, which is absolutely true, to tell its own tale. We hope it will reach the eyes of the Snowshoe shareholders and that they may not be made the unconscious instruments of inflicting another "black eye" on B. C. mining prospects. The local press, fully posted on the case, is scathing in its comments, and our esteemed contemporary the Engineering and Mining Journal handles the whole subject, and especially Mr. McMillan, without gloves. We have still one hope that this esclandre may not eventuate, it lies in the fact that Mr. Waterlow is in Canada. Hitherto his name, high in the financial world, has never been associated with a scandal and we believe that if the matter can be made to appear to him in its true colours, he will prefer the sacrifice of his Snowshoe investment to that of his reputation.

CORRESPONDENCE.

Lead in Ontario.

To the Editor:

Sir:—I notice in your September issue an article on "Lead in Ontario." Some of the statements, however, are misleading, as the description of the lead-bearing vein is inaccurate.

The "Bannockburn" vein as it is called, is in Madoc Township, and runs N. W. and S. E. The gangue, so far as known, is always carbonate of line, and, while most of the veins in

Ontario are very narrow, especially in Tudor Township (seldom over two to four inches), the Bannockburn vein runs from three feet to five feet in width.

The pure galena varies greatly, being from one inch to forty-six inches in width; one of the larger "bunches" being thirty feet long and twenty-five feet deep. The veins are all perpendicular, and in general are well defined; when the galena occurs in the country rock the impression is given that movements have taken place at a period subsequent to the deposition of the matrix.

This Company has uncovered its vein for some 2,200 feet in length, and have found its outcrop from 18 inches to 24 inches below the surface.

The lead-bearing veins in quartz gangue do not seem to be of any extent, as those which I have examined usually carry only small bunches of lead ore associated with a little copper pyrites and gold. The lead ores seem to be remarkably pure, as a number of assays have shown no arsenic, antimony, copper or zinc. The silver is very low in amount, about one ounce to the ton. The pig lead produced is accepted by manufacturers, and reported suitable for any use.

While the mine has not been thoroughly developed, having only seventy-five feet of depth, the vein holds out and shows no signs of being only a surface deposit. Active work in sinking this winter will show us more of the underground system of the Ontario lead veins.

Yours very truly,

H. F. E. GAMM, Supt.

Bannockburn, Ont., Oct. 14, 1904.

A Smelter at Republic, Wash.

To the Editor:

Sir:—Canadian shareholders of the Mountain Lion Mine and other mines in the Republic camp will hear with interest that negotiations are now completed for the establishment of a smelter at Westfork of the San-Poil River, fourteen miles below Republic.

In order to fully appreciate the value of such an undertaking, it is necessary to understand the difficulties, through which the Republic mining camp has passed since 1897. The treatment of the Republic ore was one of the principal difficulties since the mines commenced to produce ore; the once famous Republic mine has spent three-quarters of a million dollars for its two mills; much bullion was extracted from the ores of the Republic mine in the first mill, but this process, on account of its costs, could only be applied to the high grade ores (realizing over fifteen dollars a ton), while the low grade ores could not be treated at all. The result was that this mill was dismantled; a second mill was built according to the plans of Mr. Jackling and, while there is much diversity of opinion regarding the successful treatment of the ore by this process, there is one sure thing that the process, if it was a success at all, was also too expensive to be applied to low grade ores, say according to Western practice, below eight dollars a ton. This is evidenced by the fact that although there were many operators waiting for a realization on their accumulated ore, not one of them seemed to care to have his ore treated by this process, and to pay the high treatment charges demanded. This large second mill was never worked to its full capacity on account of the shortage of ore from the Republic mine; when the mill was ready to treat its full quota every day, operations at the mine were suspended on account of the failure to tap the ore body in the 600 foot level. This whole milling plant, fitted out with the most modern cyaniding and milling apparatus, was recently offered for sale at public auction in Spokane, Wash. There was no bidder, and the sale was withdrawn. The inability of the Republic mill to treat custom ore cheaply, prompted most of the other mines which had arrived at the point of realizing on their large ore reserves, to suspend operations, until the question of treatment was properly solved. The Gold and Silver Extraction Company of America then undertook the responsibility for the treatment of the Mountain Lion ore at a royalty of ten cents a ton, at the same time guaranteeing an extraction of at least 85 per cent. of the gold and 60 per cent. of the silver values. A mill for the employment of this process was constructed in 1899 at a cost of about $60,000, and was started for actual treatment of the ore on the 16th of March, 1900, but the results obtained were far from satisfactory. Altogether 11,960 tons of ore were treated, the average saving being only 54.9 per cent. of all the values. The treatment costs per ton were $3.75. Following these disappointments the mill was shut down on Nov. 1, 1900. Then there was a series of metallurgical tests undertaken with the ore, and, although the results gave some encouragement as to the percentage of extraction should further modifications of the plant and process be made, still, after the experience already gone through and the failure of previous metallurgists to verify their predictions, it was not deemed advisable to incur any expenditure for further mill modifications at that time, especially in view of the fact that it was certain that a railroad would soon be constructed to the town of Republic. This would give an opportunity of selling the ore to the smelters located on the line, which were desirous of obtaining a certain quantity of silicious ore hitherto procurable only in a limited measure. After the completion of this railroad, arrangements were at once made to make contracts for the delivery of ore with the smelters at Nelson and Grand Forks and to resume operations at the mine. Since the beginning of August, 1903, up to the present time, ore has been shipped from the Mountain Lion mine with slight interruptions, at the rate of 100 to 125 tons a day, but it was questionable whether with freight and treatment charges as low as $6.50 per ton, a reasonable profit could be made. Again it was found that the market for the Republic ore was not so large as anticipated, as the self-fluxing character of the Boundary ores does not allow of any large additions of pure silica. In October last year tests with the ore were resumed, this time with an entirely new process, invented by Dr. Hendryse, of Los Angeles, who has had a large experience in leaching gold ores in Colorado. Since the beginning of December, 1903, the old mill of the Mountain Lion mine has been altered for the application of above process, and a fifty ton agitator added. Thorough tests were made, in the course of which it was found that again radical changes had to be made in order to obtain a promised saving of 90 per cent. of the gold values, but up to this time it appears that no such saving can be effected, at least not in the treatment of a large tonnage of the average Mountain Lion ore, and unless the average run of mine can be treated successfully by such a process, there is no chance for its general adoption. The question of adequate and cheap treatment after eight years of permanent testing and an expenditure of large sums of money, which comes up to nearly three-quarters of a million dollars, is again the all-absorbing one in the camp. The inability of the mine owners to contract with the smelting companies to treat any certain amount daily has caused the closing down of a number of mines, and the curtailing of the output of a number of others; mine operators are confronted with a very serious state of

affairs—either to close down their mines entirely until a cheap treatment can be invented, entirely different from those already tested, or to make strenuous efforts to have a smelter built. Up to the beginning of this year the operators have made little effort to induce capitalists to enter this field and erect a suitable plant, for the reason that the smelter operators promised an enlargement of their plants which then would absorb all the ore of the camp. These promises, perhaps made in good faith, have not materialized, and now the mine owners, realizing the immense benefit which the community at large would derive from the establishment of a smelting plant on the spot, have taken up seriously this matter, and from information received, it appears that the erection is an assured fact. Mr. Harper, the manager of the Belcher and Midnight Mining companies at Republic, is at the head of the enterprise. The smelter will be built at West Fork, fourteen miles below Republic, on the San Poil River, in the midst of a number of mines producing copper, gold and silver ores of low grade, and lead ores. The initial equipment will consist of one copper-matte blast furnace and one silver lead stack of smaller capacity. Water power of several hundred horse power is available, and power for a part of the plant will be generated in this way. Rail transportation to the smelter is assured, and when this is completed additional furnaces will be added to handle the tonnage from the camps of the north half of the district as well as the big tonnage from the Keller district.

It is not intended that the smelter will handle at once all the ore which can be readily stoped at the Republic mines, but it is certainly an important step in the right direction. We trust that this new enterprise will be crowned with the success it deserves; and that the initial step to smelt the ores of the Republic camp will develop into an industry of large dimensions commensurate with the vast resources of the camp, for the public at large and for the benefit of the mine owners in particular.

FRITZ CIRKEL.

Montreal, October 12th, 1904.

Obituary.

As the REVIEW goes to press it learns, with the deepest regret, of the death of Mr. Cornelius Shields, at Sault Ste. Marie, Ont., on the 28th October, of oedêma, or dropsy, of the lungs, which was attended with the usual heart trouble accompanying the disease.

Mr. Shields was born in New York State in 1855, and was, therefore, forty-nine years old. He began his business career in railroading, commencing on the Northern Pacific Railway, and rapidly came under the favorable notice of Mr. J. J. Hill. He left the service of the Northern Pacific to engage with the Canadian Pacific Railway, where he filled different important positions, and resigned a post as Divisional Superintendent in the West to become the Receiver of the Virginia Coal & Coke Company.

In 1901 Mr. Shields was appointed General Manager of the Dominion Coal Company, succeeding Mr. Donkin, and in 1902 upon the temporary amalgamation of the Steel and Coal Companies, he became second vice-president and general manager of the combination.

In March, 1903, Mr. Shields resigned from the Steel and Coal Companies and accepted the presidency of the Consolidated Lake Superior Company at the Sault. Upon the reorganization of this company Mr. Shields retired from the presidency, but retained the general management.

He leaves a widow, three daughters and four sons.

For energy, prompt administration and general executive ability Mr. Shields was invaluable; his judgment was sound and his place will not be easily filled by the Lake Superior Company.

The Corundum Industry of Ontario.

(From our Special Contributor.)

The Canada Corundum Company may be said to have established the corundum industry of Ontario upon a fairly firm basis. It is now five years since this company placed its first output upon the market, and within that time it has increased its daily output from one ton to twelve tons.

It was in the fall of 1896 that Mr. W. F. Ferrier, of the Dominion Geological Survey, first drew attention to the occurrence of corundum in Ontario. Next year Dr. A. E. Barlow, on behalf of the Dominion Government, made a general examination of the rock formations, while Prof. W. G. Miller performed the same work for the Ontario Government.

There are three distinct corundum areas which have not yet been geologically connected. Of these the most northerly is by far the most extensive, and contains all the known deposits of economic importance. This northern belt extends from Haliburton County eastward across the north end of Hastings County, and the south end of Renfrew for a distance of about seventy miles. Its average width is something over two miles. In Frontenac and Lanark counties is a much smaller belt with a length of about fifteen miles. In Peterboro County is another belt, known as the Burleigh-Methuen.

Throughout the corundum-bearing areas run several systems of syenite dykes. These dykes are, broadly speaking, of two kinds, (a) Orthoclase syenite, (b) Nepheline syenite. The distinction between the two cannot be very sharply drawn, as often dykes of nepheline syenite are found, which when traced, gradually shade off into orthoclase syenite. At several points these dykes are found to be impregnated with crystals of corundum in greater or less quantities. As a rule the corundum occurs most abundantly in the orthoclase syenite, but on the York River is found a nepheline syenite dyke which is between one and two hundred feet in width, and which for over a mile carries corundum very evenly disseminated throughout its mass. Throughout this deposit the rock matter is seen to be schistose, whereas the other parts of the dyke are more or less massive.

So impressed was the Ontario Government by the importance of the discovery that the mineral rights of the corundum-bearing area were withdrawn from sale. Upon making a study of the matter the Government came to the conclusion that, as the market for corundum was not unlimited, the industry would be developed more quickly were it confined to a few strong companies. They accordingly drew up special corundum regulations and then called for tenders. The result was an agreement entered into with the organizers of the Canada Corundum Company. Under this agreement the successful tenderers were granted the right of first selection of deposits, and were given the further right to take up additional areas each year for ten years. In return, the organizers of the company agreed to expend $100,000 within three years and such further sum as should then be seen to be necessary.

In tendering on these terms the organizers of the company were in a somewhat advantageous position, as they had already acquired by purchase what is known as Craig Mine Mountain. This property, which is recognized as the largest in the district, had been taken up some years before by some local parties, who were under the impression that they had found a mountain of phosphate. The deposit itself forms the central part of the dyke which contains virtually all of the large deposits, (save the nepheline deposit above referred to, which is situate some fifteen miles from the mouth of the York River). The dyke itself has been traced for a distance of nearly fifteen miles and its strike is almost due east and west. At different points corundum is found to occur throughout it for a distance of a quarter of a mile or more. At the Craig Mine, however, the corundum is found to occur throughout the dyke for a distance of over a mile. At this point the land rises in the form of a hill about a mile in length and 590 feet in height. The dyke forms the southern face of the hill, which has a slope of 30 degrees. Towards the top of the hill a good deal of the dyke matter has been worn away by glacial action. At its west end the hill breaks off sharply, and here a good idea can be had of the thickness of the deposit. At the top where glacial action has been most pronounced, it varies from 30 to 40 feet in thickness, while towards the bottom it is found to increase to about 100 feet. Starting at the west end, the corundum can readily be traced almost without a break to the eastern end of the hill.

It is at the eastern end that most of the development has been done. This consists of open quarries into the side of the hill. One of these quarries has been carried in a distance of about 70 feet horizontally, and this summer had a vertical face of about 60 feet. In addition to this main quarry a number of others have been opened up and in all of them the rock is found to carry corundum. In many places there are considerable areas on the side of the hill that contain no soil, and on all of these surfaces the rock is found to be thickly studded with corundum crystals. This summer considerable stripping has been done and an additional quantity of corundum brought to view. At one place the face of the hill is cut by a gulley, which has a depth across the strike of the dyke of about 72 feet. The sides and bottom of this all show corundum.

Many estimates have been made of the quantity of ore in sight. A correct estimate is rather difficult. One is safe, however, in saying that the quantity is very large. The corundum is an original constituent of the dike, and as the dyke is eruptive its permanent depth is virtually certain. Should the present deposit ever be exhausted, however, the company has a number of other deposits situated in the same dyke a few miles to the west, which could be easily connected up with a short tramway. One of these deposits is quite large. Besides this, the company has ten half lots of fifty acres near Palmer Rapids, each covering deposits to the east of Craig Mine and situate on the same dyke. The railroad which is already surveyed will connect all these with the company's new mill.

The winning of the ore is so simple that it is not entitled to a long description. The work is all open quarrying and is carried back in benches. While the old mill was being worked all the drilling was done by hand. Since the erection of the new mill, machine drills have been used. As a rule, two drills have been found sufficient to supply the mill. The quantity of ore turned out at a blast depends largely upon the length of the face of the quarry in which the men happen to be working. It is not an uncommon thing for a battery shot to blow out 2,000 tons or more. The rock breaks in large masses, and these are further broken down either by plug drilling or by sand blasting. At times more or less cobbing has to be done, but the amount is not excessive. The ore, on being broken down to pieces that a man can lift, is loaded on to cars and run into an ore bin at the top of the mill.

In 1899 the company erected a small experimental mill upon a water power about half a mile distant from the hill. As the process of treating the ore was perfected, this was enlarged until about thirty tons per day were being treated.

In the spring of last year the company began the erection of a new mill with a daily capacity of 200 tons of ore. This mill was designed by Mr. G. F. Bartlett, the then superintendent of the company. He was assisted in his work by Mr. G. A. Overstrom, the inventor of the Overstrom concentrating table. It was expected that the mill would be completed last fall, but a number of delays were met with and it was not until this spring that the mill was in operation. This new mill is built on the eastern end of the hill and overlooks the York River. From the quarries the rock is carried by a tram to the ore bin already spoken of, the top of which is about the same height as the floor of the rock cut. This ore bin has a capacity of about 450 tons. Underneath is placed a 15 x 24 Blake crusher, into which the ore is fed. From this a conveyor carries the crushed rock to three additional crushers which sit over another ore bin which has a capacity of about 300 tons. Two of these crushers are 6 x 20 Blake crushers. The third is a 7 x 21 Gates crusher taken from the old mill. These crushers break the ore down to about three-quarters of an inch, whereupon it drops into the bin over which they sit. From this second bin the ore, after passing through trommels, is fed to a set of 14 x 40 crushers rolls, and from these, two to more sets of rolls of the same size, the rejections going to a fourth set of similar size. These four sets of rolls are of extra heavy construction throughout and are, perphaps, the most distinctive feature of the mill. The roll shafts are 10 inches in diameter and special wearing parts have been provided for. They run at a speed of eighty-five revolutions.

After passing through these rolls, the ore is elevated to two sets of trommels. Below these is the table floor. This contains sixteen Overstrom tables and three double, three-compartment jigs. The coarsest sizes go to the jigs, while the finer sizes are fed to the tables. The heads and middlings from the jigs are recrushed by a set of 30 inch rolls and fed to tables, while the middlings from the tables are drawn on to five more tables, situate on the floor below. The concentrates are then let run into seven bins of a capacity of 40 tons each, at the bottom of the mill, where they are let drain.

The mill building proper is 120 ft. x 65 ft. and has a height of 120 ft. Thirty feet away and parallel with it is the grader building. This is a three storey building, 120 ft by 56 ft. A belt conveyor carries the concentrates from the concentrate bins to the top of the dryer in the grader building. The dryer is very simple and consists of horizontal nests of steam pipes on which rest screens of about 4 mesh. The concentrates rest upon the screens until they have dried, whereupon they at once drop through the screen to the bottom of an elevator, which carries them to the magnetic separators, placed at the top of the building. More or less magnetic iron ore is found in the rock and the magnetic separators extract this. From the magnetic separators the ore passes to the screens and is sized into twenty different sizes running from 8 to 200 mesh. On passing through the grading screens it is let run into a number of bins.

Considerable care is taken in the concentration in the mill,

and by the ordinary mining man the concentration would be thought to be sufficiently pure. The chief use of corundum, however, is in the making of vitrified corundum wheels and if more than two or three per cent. of felspar be left in the corundum this will flux and will interfere with the bonds which are used in making the wheels. It is necessary, therefore, to re-concentrate the already concentrated material. It is found that Hooper pneumatic jigs will successfully handle the sizes between 24 and 90 and these sizes are, therefore, fed from the bins to the Hooper machines. The coarser and finer sizes, however, are fed to four concentrating tables which are situate in the grader building. This concentrating is very carefully done, and as the material fed on to the tables has already been accurately sized, a very perfect product is obtained. After being reconcentrated, all the corundum that has gone over the concentrating tables instead of the Hooper machines, is again dried, and all the corundum is then re-sized and let run into a number of other bins which are reserved for the re-concentrated material. From the bottom of these bins it is drawn into 100-lb. duck bags and is then ready for the market.

The motive power consists of four boilers of 150 H.P. each, together with three engines, one of 225 H.P., one of 125 H.P. and one of 35 H.P. for the running of the dynamo and of the lathes and other special machinery. In addition to the engines there is a new seventeen drill Rand compressor which was installed with the idea of equipping not only for present quarrying, but also for underground work should this ever become necessary.

The shipping point of the company is Barry's Bay on the Canada Atlantic Railway. The mill is twenty miles from the railway, but as this twenty miles consists of water navigation the company's transportation facilities are good. A tramway has been built from the mill to the company's wharf on the York River. Here the corundum is loaded on to scows which the company's steam tug tows to the wharf at Barry's Bay. The tug can easily handle two scows carrying from twenty to thirty tons each. There is a siding from the railway to the water at Barry's Bay and the Government is now building a new wharf there.

On account of the hardness of corundum, any weakness that may exist in the mill is sure to be found out. The company has had a number of rather serious breakages which have delayed them considerably. The extra high percentage of purity to which it is necessary to bring the concentrates has also made it necessary to go slow in balancing up the mill. The company expects, however, that before long it will be turning out twenty tons per day instead of twelve. The crushing capacity of the mill is nearer four hundred than two hundred, and the floor space is ample for the addition of new concentrating machines: hence, as the market expands it will be a very simple thing for the company to increase its capacity. At present the company is fully supplying the demand. By lowering the price, the demand can be rapidly increased. As production on a large scale is much cheaper than production on a small scale, the company's policy is to increase its output as rapidly as possible, and at the same time to lower the price to a point where the demand will take care of the output. In addition to the advantages of cheaper production, this policy also renders competition on a small scale almost impossible, and it is questionable whether other companies are in a position to produce on a large scale.

The head offices of the company are in Toronto and it is from there that its selling is at present conducted. It has established branch offices in both Paris and Berlin.

The Mines of Ontario.

By W. E. H. Carter, B.A.Sc.*

A very wide field for discussion is laid open by the title chosen for this paper, too wide, in fact, to be here gone into fully, so that only certain phases of the mining operations will be dealt with, and since the mines of eastern Ontario formed the subject of a paper (1) read before this Society at the 1902 session more attention will here be paid to mining in western Ontario. Probably the best ends will be served by making the present status of the mining industries the main topic and attempting to set forth the reasons for the abnormal inactivity in many of the mining districts.

The gold areas in particular are placed in a rather critical position, as the culmination of an unfortunate policy or method of mining which has prevailed from the start, and which may be summed up in the words, "inefficient management." This has arisen from the persistent disregard, at all but a few mines, of the need of employing a capable engineer as head, and out of the fact that few companies start mining with a really *bona fide* intent to see the undertaking through on a proper business basis. Until the trouble is squarely faced, realized and remedied, the same disappointing results from the mining ventures will without doubt continue.

The important historical points of the different mineral industries, so varied in this province, will also be dealt with, in connection with the above and in order to collectively summarize the mining development from the beginning.

While the mining industries in the eastern portion of Ontario are much more varied than elsewhere and the number of mines large, the value of the output is small compared with that of the fewer metals or minerals raised from western Ontario, which extends from Nipissing district west to Rainy River district, and this is due mainly to the product of the nickel-copper and iron mines of the latter area, and to the fact that practically the whole product is metalliferous and more valuable. There are, however, non-metallic minerals being raised, such as building stones of the greatest variety and value, from end to end of the western half of Ontario, of which but little is heard in the east on account of their distant situation and of the presence in the east of sufficient of the same class of materials for all ordinary requirements. They play an important part in the development of that end of the province simply by supplying local needs; but their value lies rather in a greatly increased future demand, a matter merely of time, than in the present small consumption. Of them no further mention will be made, since their operation comes more under the head of commercial than mining undertakings.

The facilities necessary for economic and profitable mining in Ontario are yearly increasing by the location and construction of new railways, in particular throughout this western end of the province, where they are most needed, by the settling of the country, and by the development of water powers for the transmission of electric energy to the mining and manufacturing centres. The prospector and farmer no longer confine their efforts to the older known areas, but have advanced for a hundred or two hundred miles north of the main line of the C.P.Ry. A good example of this is in the Temiscamingue country, where as a natural result a railway, the Temiscaming & Northern Ontario, has followed them. Not

*Paper read at the Sixth Annual Meeting of the Canadian Mining Institute.

(1) Can. Min. Inst., Vol. V., "Eastern Ontario: A Region of Varied Mining Industries," by Willet G. Miller.

only have good new lands been already cleared, but valuable mineral discovered, and many of those formerly known to exist are now being mined, or this year will be mined, along the road. Seldom does a railway or at least a branch line enter a new country before the prospector and farmer, and we may, therefore, expect to find that very soon other roads also will tap the new northern mineral fields, such as the northern nickel range and the iron ranges north of Sudbury, the iron ranges north of Lake Superior at Lake Nipigon, and the gold areas in parts of the west now distant from either of the two existing roads.

Gold Mines.

The first noteworthy discovery of gold was made at the Richardson mine, in Madoc township, Hastings county, in the year 1866. Since then valuable gold areas have been found from here to the western end of the province, over a distance of some 900 miles, and with nowhere a gap of more than 100 miles. And there appears no reason why gold should not be found in these stretches also when the prospector devotes his attention to them. An enumeration of the different points at which gold mining has within recent years progressed will serve to exemplify this very general distribution. From east to west the areas consist of the Eastern Ontario belt, extending through the four counties of Peterborough, Hastings, Addington and Frontenac; the Parry Sound area in the district of that name; the vicinity of Wahnapitae lake; from Sudbury west along the north shore of Lake Huron; the Michipicoton area following the belt of Huronian rocks from Lake Superior northeasterly to Dog and Missanabi lakes; along the north shore of Lake Superior at Jackfish, Rossport and other isolated localities in the area; and from Shebandowan Lake west to the Lake of the Woods and north to Sturgeon Lake, which last area comprises practically all of the Province west of Lake Superior.

Placers.

Unlike most gold regions, Ontario has no placer deposits which have so far been proved of commercial value. From time to time auriferous sands have been discovered and immediately subjected to official examination. There are two main occurrences and one consists of the gravel and sand areas along the Vermilion and Wahnapitae rivers, the more important beds of which follow the Vermilion River for a stretch of forty miles with a breadth of from one to three miles. It was generally conceded that the only feasible method of profitably working the sands would be by dredging, since the gold is mostly in fine colors and the average value of the sand not more than a few cents per cubic yard. During 1901 some tests were made with the sand with a plant erected on the ground, the idea being to combine amalgamation and cyanidation in the process. A forest fire wiped out the works, however, before much of value had been accomplished, and the attempt has not yet been renewed. The other area comprises the sand and gravel hills and beds in various parts of Savant Lake and district, which is reached by canoe northerly from Ignace, western Ontario. These sands also cover an extensive area. They differ from the Vermilion sands, however, in that but little gold could be collected by panning, while by fire assay values in the precious metals were frequent. To quote from the report thereon by Willet G. Miller: "These values (by fire assay) come from material, which is probably more or less refractory, in the rusty fragments of rock in the gravel. Only a very small percentage of the gold can be extracted by placer methods." Gold values, per ton by assay, ran all the way from traces to $2.00. Silver appeared in traces in most of the samples.

As an example of the small local occurrences of auriferous sands or other detritus, the result of either glacial action or weathering, which may be found at many places in our gold areas, those in the arsenical gold belt in Hastings county are interesting. Besides quite small beds of auriferous sand filling depressions in the rocks in the vicinity of the Deloro and other mines, one was found on the Cook property, in Marmora township, forming the bed of a swamp of less than an acre in extent, composed of large and small angular boulders of quartz and country rock carrying weathered sulphides and compactly filled with fines of the same materials. The whole was rich in gold values. It probably represents the glacially denuded portion of one of the nearby veins, deposited as a moraine against the more solid trap country.

Eastern Ontario.

To return to the discussion of the auriferous ore bodies in place as found in the above enumerated areas: In the eastern Ontario gold belt, of which a general description has already been given before this Society and elsewhere (2), a number of mines have been producing bullion recently, although at present most of the mills are closed, presumably temporarily. These include the Belmont, one of our most promising gold mines, the Deloro, the Atlas Arsenic and the Cook. Several new companies have been formed to develop other gold properties in the district, some merely prospects adjoining these known mines, and others, older mines already considerably developed.

In 1897 the Belmont mine, then merely a prospect, was acquired by the present owners, who have systematically explored most of the important showings of ore, developed a number of them, erected the present extensive mining and milling plants, and produced from that year to date 16,789.79 ounces gold bullion, valued at $289,301.76. Numerous and sufficient descriptions of the ore bodies have already been published (3), from which they are seen to be unusually large, but of low grade, requiring large milling plant and economic operation throughout. For this last, the mine is well equipped with a developed water power, and lies in a district handy to the main centres of the Province.

It would appear that amongst the arsenical-gold properties in this district an amalgamation of the different interests is necessary to bring about the continued profitable operation of the different mines, principal of which are the Deloro, Atlas Arsenic and Cook. This course has been advocated and attempted a number of times, but so far without definite result. The Deloro, a pioneer amongst these mines, has been operated off and on for the past thirty years or more, and during that period various methods for the extraction of gold values from the arsenical pyrites tried. In all of them amalgamation in one way or another formed a part. Chlorination and ordinary potassium-cyanidation proving commercially unsuccessful, the bromo-cyanide process was evolved, and has since been successfully adapted to the ore (4). The residue from the mill, after cyanidation, consists of these arsenical pyrites (mispickel) concentrates which then pass to the adjoining refinery for extraction of the arsenic. The total saving in the original

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(2) Can. Min. Inst., Vol. V., pp. 233-225; Bur. Mines, Vol. XI., pp. 186-207.

(3) Bur. Mines, Vols. X., XI., XII.

(4) "The Treatment of Auriferous Mispickel Ores," Can. Min. Ints., Vol. V.

CORUNDUM DEPOSIT ON CRAIG MOUNTAIN.

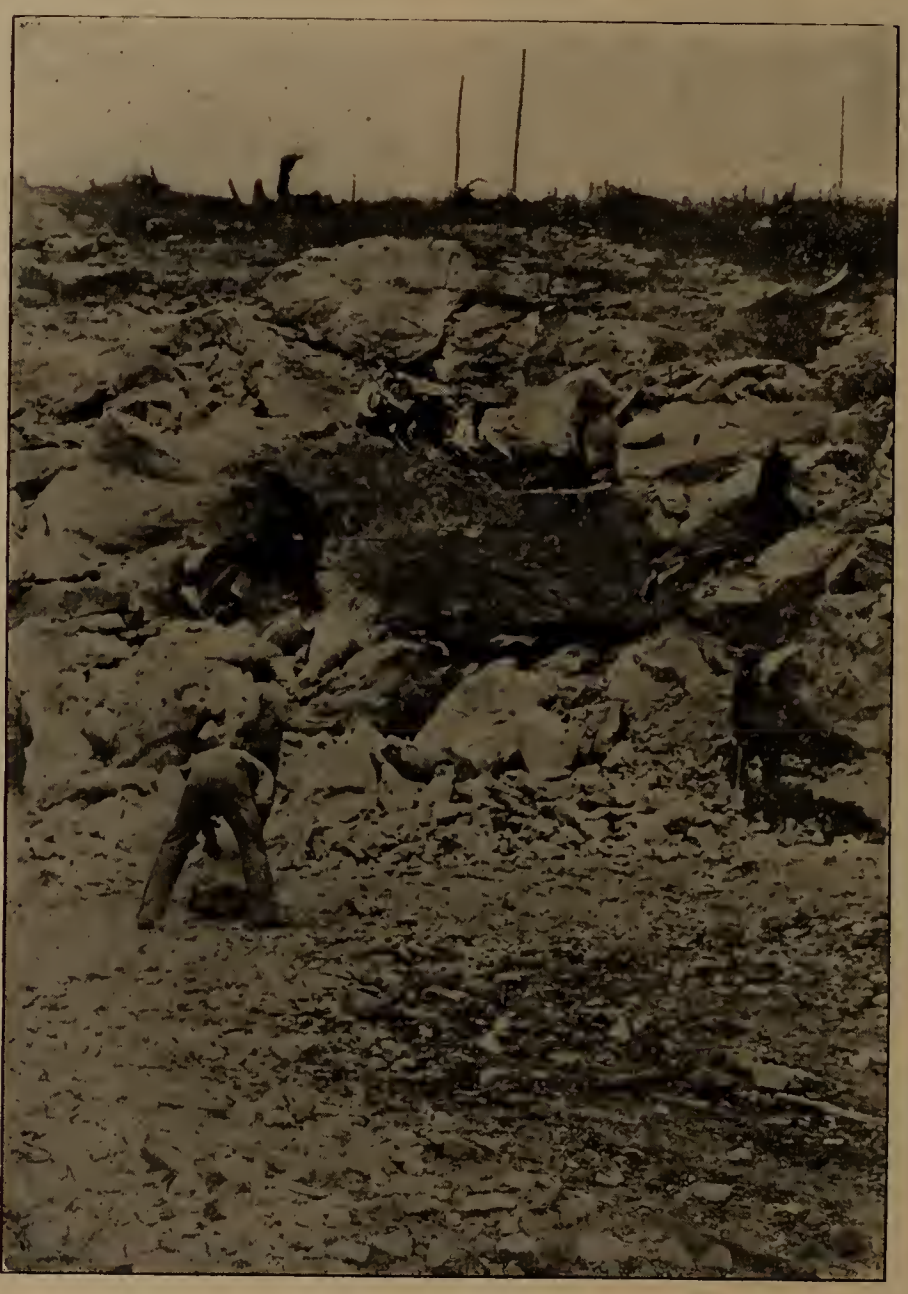
EASTERN QUARRY.

CANADA CORUNDUM COMPANY'S MILL AT CRAIGMONT, ONT.

MILL AND TRAMWAY.

MILL, FROM THE NORTH-EAST.

CRYSTAL OF CORUNDUM.



ORE QUARRY, SHOWING MASSIVE CHARACTER OF ORE.

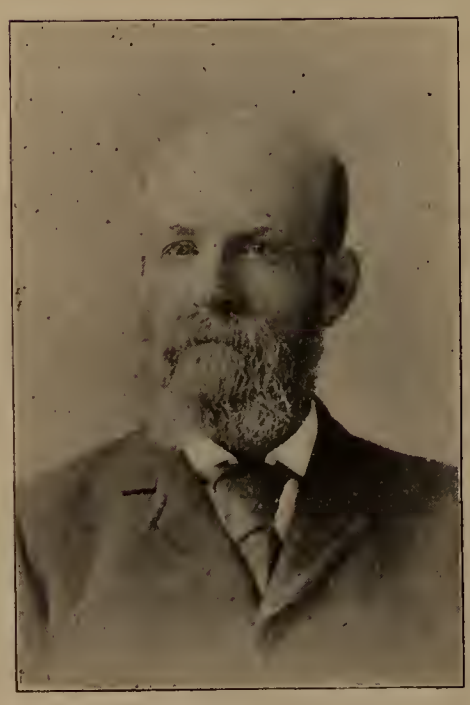
CRAIG MOUNTAIN, LARGEST KNOWN DEPOSIT OF CORUNDUM IN THE WORLD.

Loading Platform at Quarry.

Mr. D. G. Kerr,
Manager, The Canada Corundum Co.

Quarry Cut, Craig Mountain.

THE LATE CORNELIUS SHIELDS,
General Manager, The Lake Superior Company.



SENATOR MCGREGOR,
the new President of the Nova Scotia Steel and Coal Co.

THE LATE JOHN F. STAIRS,
former President of the Nova Scotia Steel and Coal Co.

gold content of the milling ore by amalgamation and cyanidation averaged from 88 per cent. to 90 per cent. during four and a half years' steady work. During the five year period of operation from 1899 to 1903, 35,877 tons of ore were raised and milled, from which the total value of the gold recovered was $181,907.55, and of the arsenic $128,975.50, making a grand total value of $310,883.05, or of $8.66 per ton.

During the year the mine of the Atlas Arsenic Co., which adjoins the Deloro, was further worked, and the ore treated in the 10-stamp mill, the concentrates going to the Deloro refinery for the extraction of arsenic.

The old 20-stamp mill, in its log building on the banks of the Moira River, about one mile below the Deloro, was a year or so ago bought by the Cook Land Company and set in operation again. It has stood here over thirty years, a most interesting contrast to the economic milling methods of to-day. The stamp batteries were very light, shaky affairs, with feed boxes of sheet iron bolted on behind. In place of crushers and automatic feeders all ore was broken by sledge and fed by hand. The cams had only one long arm, which operated stamps of about 700 lbs. weight, the daily capacity being a little over one ton per stamp. About a year ago, however, the whole plant was destroyed by fire.

Parry Sound.

The occurrence of gold in the Parry Sound area first attracted attention in 1894, in the ore of the McGown mine, which lies about two miles east of the town of Parry Sound. During the following lively exploration of the surrounding field more promise was, however, given of developing a copper than a gold area, since the gold is usually associated with the copper ores bornite, chalcocite and chalcopyrite. Laurentian gneiss and mica schist compose the country, throughout all of which scattered basic dikes have at a later age been ejected. Along more or less defined mineralized zones of the gneiss or schist, or less frequently in quartz veins, the gold and copper are found. In 1898 a 10-stamp mill was erected at the McGown mine.

Wahnapitae and Lake Huron.

In the Wahnapitae area there are as yet no producing gold mines, the only stamp mill, at the Crystal mine, on the east side of Lake Wahnapitae, having lain idle since the few runs made at the start, in 1897. This property has recently changed hands, and may, according to report, be re-opened this year.

An important discovery of gold was made last summer in the Huronian rocks in the township of Shakespeare, a short distance north of Webbwood. The metal was found, on what is now the Shakespeare mine, in unusually large nuggets, equal to anything from the gold fields of western Ontario, and in an ore body composed of quartz bands interlaminated with green schist. The existence of gold in this district, though reported before, had never been proved for certain until this find was made. Copper ores, on the other hand, occur quite frequently. Sudden discoveries of this kind are, on the whole, good for any district, and especially so for this one of ancient metamorphosed sedimentaries and of eruptive rocks, in which many minerals of economic importance may occur. From the predominance of these veins of copper pyrites interest in other minerals had somewhat lapsed.

Michipicoton and Lake Superior.

Michipicoton as a gold area was first brought to notice in 1897, and, partially aided by rumored finds of rich placer sands, a lively rush into the field followed, the route being by way of Missanabie, on the C.P.R. to the north. Now, access is had by steamer from Sault Ste. Marie in summer, and by sleigh from Ryerson near Missanabie in winter. The Grace was the first mine systematically developed and since the completion of its stamp mill, and the subsequent production during 1903 of gold bricks enthusiasm in the possibilities of the veins of the area has been considerably aroused. Already a number of other mines formerly only superficially tested have been developed fairly extensively. A stamp mill was last year erected at the Manxman mine and another is promised for the Mariposa.

The auriferous veins in the area are much alike throughout in their usual compositions of white, glassy quartz containing more or less intermixed streaks of black to light green schist (remnants of the country), with little or no sulphides of any kind. They are quite numerous and often of great width (30 feet or more), and confined for the most part to the Huronian series of rocks in the vicinity of the Laurentian granite and gneiss. A noticeable similarity exists between these altered traps, green schists, quartz porphyries, etc., of this Huronian area and the gold bearing rocks of western Ontario; and also between the characteristics of occurrence of the ore bodies in each.

Between Michipicoton and the western shores of Lake Superior isolated gold mines have been worked, at Jackfish for instance and at Rossport, but these have not reached a commercial basis of operation as yet.

Western Ontario.

In the western Ontario gold area during the earlier days of the industry each of the newly discovered gold areas was separately designated; but with the more general examination of the country, aided by the increased railway facilities, practically every section of this immense field has been reached and all these separated areas found, as far as their gold bearing possibilities are concerned, to merge into one. From Shebandowan Lake on the east, to the Lake of the Woods on the west, and north beyond the C.P.R. as far as Sturgeon and Minnietakie lakes, in an area about 240 miles long east and west by 100 broad north and south, auriferous veins or deposits have been found and more or less developed within comparatively short distances of one another. Even the supposedly barren Laurentian, comprising probably two-thirds of the area, contains auriferous veins and reefs, while the Huronian of the remaining one-third may be explored for gold with good chance of success throughout.

The first important find of gold in the area was made in 1871 at the Huronian mine in the township of Moss, where as early as 1883 a stamp mill was erected to treat the ore; but adverse circumstances, chiefly inaccessibility at the time, were, apparently, too much for its successful operation. The ore is unique in Ontario as containing the only known occurrence of sylvanite (gold-silver telluride). The Lake of the Woods area, according to the reports, was the next point of discovery of gold, in 1878 or earlier. As a result of the exploration of these two fields the whole of the west has been gradually opened up.

With regard to the structural geology of the area, I quote from Dr. A. P. Coleman's summary in the report of the Bureau of Mines, vol. VI., pp. 114-115:

"The gold area of Ontario is of an almost unique kind. In many respects no other gold region can be compared directly with it, and the laws governing its auriferous deposits should be worked out for themselves. On this account it will be useful to sum up our present knowledge of its geology. There is, perhaps, no other large gold region confined to rocks of so

ancient an age as the Archean; and something should, therefore, be said as to the arrangement of these rocks. In general, the excellent work of Dr. Andrew C. Lawson, formerly of the Canadian Geological Survey, now of California University, may be accepted as laying the foundation of our knowledge both of the Lake of the Woods and the Rainy Lake districts. The general principles worked out by him for these parts of the region are found to apply also to the Seine River, Manitou and other more recently discovered districts.

"As explained and mapped by Lawson, the region consists of Laurentian and Huronian rocks, the term Laurentian being used in a petrographical, not historical, sense, and the probable Huronian being called Keewatin. A group of more or less modified sedimentary rocks, consisting of sandstones, mica schists and gneisses, Lawson names Couchiching and places beneath the Huronian; but as they are seldom or never gold bearing, they require no further mention here.

(To be continued.)

Commercial Wet Lead Assay.

(Concluded.)

"Numerous trials were made by taking weighed quantities of pure lead sulphate, dissolving them in slightly acid ammonium acetate, diluting slightly, running in a slight excess of the standard chromate solution, and, after filtering and washing, determining the excess by 'hypo' titration. These tests have shown that the precipitation of the lead is in strict quantitative accordance with equation (1), so that in preparing the chromate solution with pure salt it will be found to check exactly its theoretical value when standardized against pure lead sulphate under the conditions of the assay.

"The accuracy of the standard having been determined against pure lead in solution as lead acetate, extended experiments were made to determine the possible interference of other elements, testing them in successive experiments by adding a different metal in the form of its convenient salt to each of a series of flasks, containing weighed quantities of pure lead sulphate; then digesting with nitric and sulphuric acids to complete white fumes; cooling; diluting with water; reheating in order to dissolve soluble sulphates; filtering; washing; returning the filter and its sulphates to the original flask; adding slightly acid ammonium acetate; and digesting a few minutes until the lead sulphate had completely passed into solution—all in the usual manner of wet lead-assays. These respective solutions were then diluted slightly with cold water, and titrated with the standard chromate and 'hypo' solutions, as described for the pure lead standard.

"These trials were made repeatedly, not only on artificially prepared charges, but later, on actual mixed ores, covering all conditions. The only possibly interfering elements are those which under these conditions do not go into solution readily as sulphates, and of these the calcium-barium-strontium series, tungsten and antimony, are the only ones commonly occurring. Lime, although troublesome to wash, causes no interference in the results for lead, though any lime that might be in solution in acid ammonium acetate; since calcium chromate is freely soluble. Barium and strontium salts remain insoluble as sulphates, and tungsten yields the insoluble tungstic oxide, hence the compounds of these three elements cause no interference. Antimony, when present in considerable quantity, caused the results to be slightly low. This was found to be due to imperfect solution of the lead sulphate in slightly acid ammonium acetate in the presence of the residual mixture of antimony oxides, varying from Sb_2O_2 to Sb_2O_4, and Sb_2O_5, depending on conditions. This difficulty was rectified by prolonging the digestion of the filter and its contents, and using slightly ammoniacal ammonium acetate for the digestion, in order to offset the acid nature of the antimony residues. The solution was then slightly acidified by the addition of acetic acid after dilution, and before adding the standard chromate. In none of these cases is it necessary after digesting with ammonium acetate to make a second filtration before adding the chromate; the flask with its contents and the remains of the filter, when cooled and diluted, are ready for the precipitation by chromate.

"In adding the standard chromate solution, it is desirable, if the lead content of the assay be known approximately, to add only a few cubic centimeters in excess, in order to minimize the washing and a lengthy back filtration. The filtration may be made directly after adding the chromate solution, using an ordinary 11 cm. filter of S. & S. No. 597, or No. 604, or any other fairly rapid and close paper; the lint present in the flask from the partial disintegration of the original sulphate filter serving to check any tendency of the lead chromate to pass through. For the reason that the total bulk of the solution is only about two funnelfuls, and the precipitate one that is readily washed, this operation consumes but little time, and a 250-cc. serves to accommodate easily the filtrate washings and the hydrochloric acid necessary to liberate the iodine in the back titration.

"In dealing with fair percentages of lead, the exact quantities of ammonium acetate and of water for dilution are not of great importance; but when only about 1 per cent. of lead, or less, is present, and it is desired to make the filtration for the back titration directly after adding the chromate, it is necessary to keep the bulk of the strong ammonium acetate solution used within 10 cc., and to dilute with cold water to a bulk not exceeding 50 cc., before adding the chromate. As had been proved by careful experiments in this laboratory, in passing far beyond these limits, the solution seems to be, on the one hand, too strong in ammonium acetate for the small quantity of lead present, and, on the other hand, too dilute in milligrams of lead per cubic centimeter for the complete instantaneous precipitation of the lead chromate, although, if the time can be afforded, the precipitation becomes complete on standing a few hours, even when widely past the limits given. From adding a large surplus of chromate solution, complete precipitation results at once, but such a surplus for back titration is not desirable in dealing with small or fractional percentages of lead. If desired, however, an excess of chromate solution can be added, and, after filtering, instead of a back titration (except in the presence of antimony), the funnel with its filter may be placed over a clean flask, and hot dilute HCl (1:1) added to the original precipitation flask, in order to dissolve the lead chromate precipitate therein contained, taking care that the remains of the sulphate filter do not retain any undissolved precipitate. This hydrochloric acid is then poured through the funnel to dissolve the portion on its filter, washing both flask and filter with warm water. This hydrochloric acid solution of the lead chromate, after adding a little potassium iodide, is ready for a direct titration with 'hypo' solution in the same manner as that for the back titration, and the results are perfectly concordant with those calculated from the back titration.

"The bulky residues present from the large ore charges usually used in low grade assays render this modification tedious, owing to the time necessary in washing these residues free from the excess chromate solution, and it will be

found more satisfactory to use the back titration with the slight surplus of chromate solution.

"Within the past few months I have had occasion to make several hundred wet lead-assays on ores and mill products from south-eastern Missouri of an average composition of about $CaCO_3$, 45; $MgCO_3$, 30; SiO_2, 8; Fe, 5; and lead, from 0.2 to 5 per cent., depending on the product. These assays were made in triplicate, by the chromate method above described, and very satisfactory accordance was obtained in each set, a triplicate series of the results obtained for the lead content, taken at random from the assay files, is given in Table I.

TABLE I.—Results of Lead Determinations by the Chromate Method :

Material Assayed.	I Per Cent.	II Per Cent.	III Per Cent.
Slimes, Lot No. 2	3.13	3.16	3.13
Middlings	0.50	0.52	0.52
Tails	0.19	0.19	0.20
Concentrates	56.20	56.00	56.20
Concentrates	34.10	34.20	34.00
Middlings	0.62	0.64	0.64
Tailings	0.22	0.24	0.24
Slimes	3.88	3.94	3.90

"In practice the method takes about the same length of time as the molybdate method on the same type of ore.

"After making some scores of assays in this manner on these heavy lime ores, it occurred to me that possibly the sulphuric acid feature might be omitted entirely, thus avoiding the tedious washing of the resultant bulky masses of calcium sulphate, without affecting the accuracy of the results. Experiments resulted in the following short cut method for heavy lime ores. To the ore charge of from 1 to 5 g. in a 250-cc. flask and from 3 to 5 cc. of strong nitric acid and 15 cc. of strong hydrochloric acid; digest until everything is in solution, and the excess of acid has been reduced to about 8 cc. The whole operation on the hot plate requires but 15 minutes. The flask is then removed, and slightly dilute ammonia is added slowly in slight excess, the neutralizing action being sufficiently vigorous to render the contents of the flask quite hot. Acetic acid of 80 per cent. strength is then added slowly, the flask being shaken vigorously, until its smell indicates a decided excess of acetic acid. Then 5 cc. of strong ammonium acetate is added to insure the solution of any lead compounds remaining undissolved by the ammonium acetate already formed in the flask.

"If the ore contains no antimony, or separated gelatinous silica, and if the siliceous residue in the bottom of the flask is only in slight amount (as is usual with heavy lime ores or with concentrates), add to the hot, undiluted and unfiltered solution an excess—about 10 cc.—of a 10 per cent. chromate solution. Under these conditions, the bulk of the contents of the flask will not exceed 50 cc.; and, after shaking and letting the precipitated lead chromate settle for about five minutes, the contents are filtered through a 11 cm. filter of any fairly rapid and close paper. If these directions are carried out, the lead chromate will be quite granular, and will show no tendency to run through. The precipitate in the flask and on the filter is washed several times with hot water containing about 0.5 per cent. of acetic acid until free from soluble chromates. The funnel with its filter is then set over the original flask, and hot dilute hydrochloric acid (1:1) poured through the filter, dissolving the lead chromate. Further additions of hydrochloric acid are made if necessary until all lead chromate is dissolved from the filter; then it is washed with warm water until free from chromate.

"The original flask now contains nothing but the hydrochloric acid solution of the lead chromate and the washings, which, after adding a small crystal from 0.5 to 2 g. in weight of potassium iodide, is titrated direct with standard 'hypo' solution whose value is known in terms of lead, the most suitable strength being that in which 1 cc. is equal to 5 mg. of lead. In this operation, by using only a small quantity of potassium iodide and having the solution fairly strong with hydrochloric acid, (about 50 cc. of hydrochloric acid, 1:1, in a total of 200 cc. of solution) and somewhat warm, any tendency of the lead to form yellow scales of lead iodide, and thus somewhat obscure the end reaction with starch, is completely checked, and the end reaction has the same sharpness as in the back titration of the originally described sulphate chromate method.

"This modification of the chromate method, as will be seen, does not consume, for heavy lime ores, more than one-half the time of the sulphate chromate method. It was so attractive that extended trials were made to see if its results in daily practice were concordant with the sulphate chromate method which had already been thoroughly tested. Several hundred wet lead-assays were run by this method in parallel with the sulphate chromate method not only on lime ores, but on siliceous ores, tailings, concentrates and artificially prepared charges containing various additions of possibly interfering elements. It is needless to give details of all the tests made; as to the influence of such possibly interfering elements, the results, verified by repeated trials, are as follows :

"1. No interference is caused by the presence of aluminum, iron, arsenic, calcium, magnesia, copper, cadmium, zinc, uranium, phosphorous, tungsten or vanadium, under the usual conditions of the assay, as previously described; the results being concordant with those of the sulphate chromate method.

"2. Manganese causes no interference, but remains in solution, provided the precaution is taken to have the digestion of the ore made with sufficient hydrochloric acid in the proper ratio to nitric acid in order to insure that all of the manganese will be transformed to chloride.

"3. Barium, if it passed into solution, would cause high results, because barium chromate is insoluble; but this element usually occurs as sulphate, and, under the conditions of the assay, it remains insoluble, and is therefore unaffected by chromate solution. Even if it occurred as a carbonate, there are usually sufficient sulphates formed from the oxidation of sulphides to cause it to separate out as the sulphate salt. However, to insure this reaction, it is only necessary, in dealing with ores containing barium, to add 1 or 2 cc. of a 10 per cent. solution of ammonium sulphate, along with the usual addition of ammonium acetate. The same considerations apply to strontium salts, should they be present in the ore, with this difference, that even if some strontium did pass into solution, it would only be precipitated as chromate from a highly concentrated solution.

"4. Bismuth, on the addition of ammonia, forms a hydrate, which, if in considerable amount, does not clarify completely with the addition of acetic acid; and, although this precipitate on solution in hydrochloric acid causes no reaction with potassium iodide, it is more or less bulky if present in large quantity, and it is troublesome mechanically in washing the precipitate of lead chromate. Therefore, in the presence of large amounts of bismuth, the sulphate chromate method is the more rapid.

"5. Antimony forms a residue of variable composition, which, if brought on the filter along with the precipitate of lead chromate and dissolved by hydrochloric acid, reacts strongly with potassium iodide and renders the assay un-

reliable, so that in the presence of antimony the sulphate chromate method, which is in this case perfectly satisfactory, must be used.

"6. Silver forms an insoluble silver chromate, which would be brought on the filter along with the lead chromate, and thus increase the weight of the latter by the quantity of the former present; and if this quantity is more than negligible it would entail a correction for silver, or would call for the use of the sulphate-chromate method.

"As a summary of the foregoing, it may be said :

"I. The sulphate-chromate method is applicable to the accurate determination of lead in all quantities, and in the presence of all commonly occurring elements.

"II. The modification of this method, by omitting sulphuric acid and bringing the ore into solution in nitro hydrochloric acid, with the precautions already cited, is applicable, except in the presence of antimony, or in the presence of considerable amounts of bismuth or silver; and it is a decided short cut in point of time for ores containing a high percentage of lime. For siliceous ores and products leaving so large a residue, or separation of gelatinous silica, by the initial procedure of this method as to render a preliminary filtration advisable before adding the chromate, the bulk of solution produced by this operation and its attendant washings becomes so large that, on adding the chromatic solution, the lead chromate, except on standing some time, does not separate out in a form sufficiently granular to remain completely on the filter, but tends to run through; in such cases the sulphate-chromate method will be found more satisfactory and more expeditious.

"The screen-test on the tailings from a heavy lime ore (Table II.) gives a good idea of the class of work that can be done on small percentages by the chromate method. The lead value, as given for each screen size, represents in each case the mean of three determinations, and the greatest variation in any instance was less than 0.33 per cent. Two of these determinations were made by the sulphate-chromate method, and one by the modified, or short-cut method. The assay value of the original tailings was 0.55 per cent., and the separate assays of the screen sizes, when afterwards multiplied by their respective weight percentages, amounted to approximately 0.57 per cent.

TABLE II.—Tests of Tailings from Dry Screenings.

Product.	Weight.	Weight.	Wet Lead.	Product of Screen. Size.
	Grams.	Per Cent.	Per Cent.	Per Cent.
Original tailings	2,000	....	0.55	.....
On 10-mesh	302	15.1	0.28	0.0422
On 20-mesh	722	36.1	0.30	0.1083
On 40-mesh	398	19.9	0.34	0.0676
On 60-mesh	140	7.0	0.41	0.0287
On 80-mesh	25	1.25	0.45	0.0056
On 100-mesh	54	2.70	0.76	0.0205
On 120-mesh	59	2.95	0.74	0.0218
Through 120-mesh	300	15.0	1.82	0.2730
Total	2,000	100.0	....	0.5677

"A wet method capable in ordinary routine work of yielding such a concordance in fractional lead percentages is, it would seem, worthy of consideration on the part of analysts.

Alumino-Thermics.

An exceedingly interesting lecture and demonstration was delivered at McGill University, on October 7th, on a new means of creating high temperatures. The lecturer was Dr. Hans Goldschmidt, of Essen-Kuhr, Germany, who is the discoverer of a method of producing high temperature by means of chemical reaction between metallic aluminum and peroxide of iron. Dr. Goldschmidt has given to this mixture, which contains the metal and the oxide in certain definite proportions, the name of Thermit, which has been registered as a trade mark.

If this mixture is ignited it burns rapidly (in a few seconds) and completely, producing artificial alumina (Al_2O_3) and metallic iron, which is of remarkable purity. The heat of this combustion is given at 3,000 degrees Centigrade, or far above the melting point of most substances, and to this fact is due the first application of the mixture as a means of welding rails for street car service, pipes, marine shafting, and for repairs to iron and steel construction of all kinds.

For rail welding it has been successfully used at Leeds, England, by Mr. J. S. McGregor, the engineer of permanent way of the City Tramways, and by Mr. Cole, the engineer in charge of the Singapore Tramways, India, as well as by the Electric Tramway Company of Berlin, which has, by this method, welded 13½ miles of track.

To the transportation engineer it most strongly appeals, but its possibilities in minor metallurgical work will be more interesting to readers of the Review. These are not few in number, if we may judge from the records submitted. By the use of ores of chromium, tungsten, manganese, molybdenum, etc., etc., in the place of iron oxide there have been produced metallic chromium, tungsten, manganese, molybdenum, cobalt, nickel, etc., etc. A number of novel alloys, such as lead-barium and manganese-boron have also been made but not, as yet, exploited.

The production of carbonless metals and alloys, and the applications in foundry and repair works, which present themselves as possibilities are worthy of note, and the Review presents the subject with the object of making known to its readers an agent now at their disposal for their investigations. Mr. William Abbott, 334 St. James Street, Montreal, is the Canadian representative of Dr. Goldschmidt.

MICA NOTES.

The Captain Adams Mica mine, on lot 2 in range VIII of North Burgess, is a new addition to later discoveries. Mica has been found in conjunction with phosphate, and lately a lead has been opened up, which bids fair to become a good producer. The mica occurs in a small vein of three feet in width near a band of phosphate intermixed with calcite, close to the contact with the gneiss. Eight men are at work. Operations were started on the Baby mine on lot 13, range V, Township of North Burgess, last February, by the new owners, Messrs. P. C. McParland and J. J| Smith. The main shaft has a depth of 95 feet, and is sunk on a solid mica vein, near the contact with gneiss. The vein on the surface is opened up for 60 feet in length to an average width of eight feet ; at 45 feet depth the length of the opening is 50 feet, contracting to 25 feet at the bottom of the pit. The lead consists of calcite, a soft pale green pyroxene, micaceous matter and mica crystals—the latter of perfect shape and quality. The mine is operated with the aid of a small machinery plant, consisting of boiler, steam hoist, derricks, machine drills and a Cameron pump.

The Hanlan mine on lot XI. concession VI. is now owned by the General Electric Company of Schenectady N.Y., and has been developed to a large extent. The main workings consist of an open cut from the surface, following the strike and the dip of the vein between a belt of pyroxene and a gray gneiss. The depth of the shaft is 120 feet, with a clean stope of 150 feet length in the bottom. At fifty feet north of the main workings another pit was sunk some time ago to a depth of 20 feet, and still further north other outcrops indicate the continuance of the vein in that direction; to the south the vein can be followed for a distance of over 200 feet, when it disappears under a swamp. The mine is equipped with a small machinery plant; a large boarding and store house, and stables, etc.

The Byrnes mine, lot 11, concession VII., is an old phosphate property, and has also been taken over by the General Electric Co. The mica found on this property is of a dark black color, and shows a marked difference from any other mica found in the vicinity. The principal opening on this property is a long cut with a strike N.W. 40 deg., in pydoxene along the contact with micaceous and hornblende gneiss, and to a depth of nearly 100 feet. It is the intention of the owners to test this property thoroughly with a Diamond drill.

The principal mine in Ontario, and one which has yielded a considerable tonnage of mica is the Lacey Mine, situated about four miles from the village of Sydenham and comprising lot VII of Loughboro Township, Frontenac County. This mine is now owned by the General Electric Co. The main workings consist of a shaft 165 feet deep divided into six levels; the horizontal extension of the underground workings amounting to over 200 feet. An air shaft connects with the main workings by a drift at a depth of 50 feet. The shaft mouth is timbered with 6 x 6 collar to a depth of 25 feet. All these workings open up a large deposit of mica imbedded in pyroxene. The deposit is remarkable on account of the large-sized mica crystals found all through it, and on account of the peculiar character of the deposition of the mineral. The formation surrounding the main shaft of the Lacey

mine has been thoroughly tested by trenches, open cuts and diamond drilling. The mine is equipped with an efficient machinery plant, consisting of air compressor, a double cylinder hoist, several pumps, and all the accessories for mining on a large scale. In busy times there are from 80 to 100 men employed. The camp consists of a new commodious boarding house, dry house, store house, stables and house for foreman.

The mica from the mine is roughly cleaned and trimmed, and then sent by scow over the lake to Sydenham, where the company operates large trimming works, where from 20 to 25 persons, and during the busy season upwards of 50, are employed. After the mica is cleaned it is sent to the cutting establishments of the company at Ottawa.

In Quebec a number of mica mines are in operation, but owing to the present slackness in the demand most of them are working with half the number of persons usually employed.

The Blackburn mine, near Perkin's Mills, which operates lot 10 in 11th range of Templeton, is one of the large producers of mica in Quebec. The workings comprise an open quarry 200 feet long and 100 feet wide, with a depth of 60 feet, also a vertical shaft which is now being sunk to 280 feet. The main vein has been worked to the 240 feet level, and consists for the greater part of large chain-like accumulations of mica crystals, imbedded in a matrix of soft green pyroxene, intermixed occasionally with calcite and phosphate. There is a force of 60 men now employed, and the mine is fitted with an efficient machinery plant. Air is used for drilling and pumping. Mine and camp are lighted by electricity from a 60 light dynamo. The mica is roughly cobbed at the mine and then shipped to Ottawa, where the company operates a mica trimming works. Here the mica is prepared for the market, by being thumtrimmed, knife trimmed or thin split according to demand. Forty hands are continuously employed at the Ottawa factory.

The Wallingford Mica Mining Co. is operating its mines, situated near Perkins' Mills and on Battle Lake, in the Township of Templeton, with a force of about 60 men. The mine near Perkins' Mills has been operated continuously for mica for over ten years, and has been one of the largest Canadian producers of mica. The main vein, where most of the work has been done, is a contact deposit between a soft pale green pyroxene and a grey and reddish gneiss, the matrix is mostly calcite and pyroxene, and pockets of phosphate are also met with occa sionally. The main openings have a length of 125 and 200 feet respectively. The underground works consists of drifts along the mica vein, and crosscuts from the bottom of 125 foot shaft to another parallel deposit, the outcrops of which appear on the southern side of the shaft. There are several hundred tons of mica of the smaller sizes stored, which were extracted some six years ago when these sizes were not in demand. The mine is equipped with adequate machinery, and all accessories for the employment of 75 men, with commodious camp for the accommodation of 50 men. The mica is roughly culled at the mine and then sent to the cutting works owned by the company at Ottawa.

The Battle Lake property belonging also to the Wallingford Mica Co., is remarkable on account of its production of large sized mica. It comprises lot 4 and 5 range XIII, Township of Templeton. The productive mica deposits occur on the north shore of Battle Lake. The main workings consist of a longitudinal opening near the lake of fifty feet length, thirty feet wide, with an average depth of twenty feet. There is also a pit sunk to a depth of forty feet, following a vein of mica which sends out spurs into a soft pale green pyroxene. The mine is equipped with a small machinery plant, and a spacious boarding house for the accommodation of thirty miners.

Mr. C. A. Johnson, of Toronto, recently bought the property operated formerly by the Wakefield Mica Co., Limited. The main workings are on lot 16, second range of Wakefield, and consist of a shaft sunk on the hanging wall of a well defined vein or lead. The depth of the shaft is 85 feet, and the depth of the open cut from which this shaft starts is also 75, making in all a total depth of 160 feet. The main constituents of the vein are calcite and mica, occasionally intermixed with pyroxene and apatite. This shaft has yielded several hundred tons of fine commercial mica. The mine is equipped with an electric plant for hoisting and drilling purposes. The mine is in shape at present for operations on a large scale.

The Laurentide Mica Co. Ltd., of Ottawa, are pushing work on lot 19, range VII, in the Township of Hull, recently acquired from Brown Bros., of Cantley. A large amount of work has been performed on this property since the company came into possession of the same in February last. The principal opening is 58 feet in length, 22 feet deep and 30 feet wide. Three horse derricks are in use, and a machinery plant is now being installed. The whole property has been systematically developed to determine its value. The mine has a large boarding house for the accommodation of 75 men, cobbing-shed, office dwelling and store house. Fifty men are steadily employed. All the mica mined is roughly cleaned and culled, and sent to the mica cutting establishment at Ottawa, operated by the same company.

There are six mica cutting factories in operation in this country, the largest of them being in Ottawa. The General Electric Co. is working with a force of 80 girls in their spacious building on Isabella Street, Ottawa. These modern quarters are fitted with the best splitting and cutting apparatus, run by an electric motor. The electricity is supplied by the Consumers Electric Light Co. The rough culled mica coming from the mines in Quebec and Ontario is again subjected to a thorough cleaning process; the mica is split, thum-trimmed, graded into different sizes, then cut by machine knives, operated by girls. These knives, compared with those formerly employed, have the advantage that, by reason of their peculiar mounting, an acc impossibility. These works handle all the output of the mines worked by the above company. In busy times from 400 to 500 girls are employed. All the waste mica, consisting of small-sized mica sheets has been stored away, in expectation of new requirements in the market for this size.

The Laurentide Mica Co. moved, last month, from their shops on Victoria Island into their modern two-storey brick establishment on Duke Street in Ottawa. This spacious building measures 88 x 98 feet; all the machinery is run by electricity, and is fitted up for the employment of upwards of 500 girls. In the upper story is the trimming and thin splitting department, while the ground floor contains the different store rooms, machine cutting department, office and shipping room. At present only 100 girls are employed; the company handles the output of its mine at Chelsea and of the old Brown Bros. mine, but expects to have several other mines in operation before long. Of other mica cutting establishments may be mentioned: Blackburn Bros., who employ 40 girls; Wallingford Bros., Messrs. Munsell, the Sills-Eddy Co., all located at Ottawa, and Kent Bros. at Kingston.

BOOK NOTICES.

Messrs. John Wiley & Sons have just published in a neat little volume three addresses of the distinguished metallurgist, Dr. James Douglas. The address on "The Characteristics and Conditions of the Technical Progress of the Nineteenth Century" was Dr. Douglass's presidential paper, read at the California meeting of the American Institute of Mining Engineers in September, 1899, and is a thoughtful presentation of the progress of the century then just closing. The other two addresses, delivered before the students of the Missouri and Michigan Schools of Mining, are notable for their keen criticism of many points in modern technical practice. The older man, as well as the student, will obtain many subjects for thought by the reading of this book. It is on sale, at the price of $1.00, by the publishers.

The publishers of "Page's Magazine" announce that hereafter the magazine will be issued as a weekly under the name of "Page's Weekly." Page's Magazine is one of the newer English Engineering Magazines which has rapidly reached a large circulation by reason of the excellence of its articles and illustrations. The range of topics is well illustrated by the last issue on the monthly basis; an article on Technical Education, two on power plants, one on hydraulic power for mining work, one on portable steam engines, with descriptions of new turbine motors, the latest wire wound gun, and copious news notes in the various branches of engineering, all make up an intellectual feast for the engineer, who may pick such bits as are of particular importance to him.

Mining Share Market.

In the mines there has been but little movement during the month, the transactions in shares were very small, and there is no speculation worth recording. St. Eugene and Canadian Gold Fields are firm, on the prospect of the former having a dividend in sight. It is reported that the returns from Moyie are very satisfactory, and that at the annual meeting next month a very satisfactory report will be issued. A good deal of Granby has changed hands; the buying appears to come from the same source, viz., Americans who have established a fixed price and who take all stock offered.

In the industrial shares there has been considerable activity and fluctuation in prices. Dominion Iron & Steel common advanced to 15, but has since reacted, owing to speculation receiving a check, due to the labor troubles. The demand for the preferred shares is steady and chiefly by investors; the same may be said of the bonds.

Nova Scotia Steel is at the moment neglected, the small boom in the stock inaugurated a few weeks ago has petered out, interest in the local market having drifted into other securities.

The following list shows the quotations for the month ending Saturday, October 29th, as supplied to the Review by **Robert Meredith & Co., 57 St. Francois Xavier Street, Montreal:—**

Par value of Shares		Asked.	Bid.
.10	Canadian Gold Fields Syndicate	.06	.05
5.00	Cariboo Hydraulic	.75	—
1.00	Centre Star	.25½	.25
1.00	Deer Trail Consolidated	.02	—
1.00	Giant	.03½	.01
10.00	Granby Consolidated	3.75	3.62½
10.00	Montreal and Boston	1.00	—
1.00	North Star	.02	—
1.00	Payne	.04	.03
1.00	Rambler Cariboo	.17	.14
1.00	Republic	.03½	—
1.00	St. Eugene	.45	.41½
1.00	War Eagle	.12½	.11
1.00	White Bear	.04¾	.04¼
100.00	Nova Scotia Steel (common)	.62	.61
100.00	Ditto ditto (preferred)	—	1.05
100.00	Dominion Coal (common)	.55½	.56
100.00	Ditto ditto (preferred)	—	—
100.00	Dominion Iron and Steel (common)	.14½	.14
100.00	Ditto ditto ditto (preferred)	.42½	.42
——	Ditto ditto ditto (bonds)	.75½	.75

PERSONALS.

Mr. James Liddicoat has been appointed Deputy Mining Recorder at Fort Steele.

Mr. F. J. Smith, the editor of the Moyie Leader, has been appointed Deputy Mining Recorder at Moyie.

Dr. Borgstrom from Finland, has been appointed assistant in Mineralogy at the School of Mines in Kingston.

Mr. John McKane, formerly well-known in Rossland, is a resident of Tonopah, Nevada, where his mine has turned out to be exceedingly productive.

Mr. Milton Hersey, the well-known chemist of Montreal, has returned to Montreal after attending the meetings of the American Chemical Society in New York.

Mr. J. M. Bell, who was in the employ of the Ontario Government during the summer, making an investigation of the iron ranges, has returned to Cambridge, Mass.

Mr. T. D. MacFarlane, who for some time has been a clerk in the Gold Commissioner's office at Dawson, has been appointed Mining Inspector for the Yukon Territory.

Mr. R. W. Brock, professor in the Kingston School of Mines, has been appointed an arbitrator in connection with the proposed amalgamation of Centre Star, War Eagle, Le Roi and other Rossland properties.

Senator James D. McGregor, of New Glasgow, will probably succeed Mr. Stairs as President of the Nova Scotia Steel & Coal Company. Senator McGregor, who is vice-president of the Company, has been acting president since the demise of Mr. Stairs.

Mr. C. C. Starr, formerly of the firm of John Starr & Company, has been appointed sole representative for the Maritime Provinces of the Canadian Westinghouse Co., Limited, with offices at 134 Granville Street, Halifax.

At the opening meeting of the Iron and Steel Institute of G. B., held in New York on Oct. 24th, the Institute conferred its Bessemer gold medal upon Mr. Andrew Carnegie. Mr. Carnegie is the first American to hold the office of President of the great British Institute.

Mr. E. R. Faribault, C.E., and Mr. J. A. Robert, of the Geological Survey, have received gold medals from the jury of the St. Louis Exposition for the glass model exhibited which represents the geological structure of the Goldenville, Nova Scotia, gold district. The model is ingeniously constructed of glass, lighted from within by electricity, and exhibits a mile in length of the district to a hypothetical depth of 2,000 feet. The actual workings are shown to a depth of 475 feet.

Mr. R. L. Broadbent, of the Dominion Geological Survey, was also awarded a gold medal as collaborator of the exhibit, of which he had charge for the Dominion Government.

The following appointments have been made to the teaching force of the Michigan College of Mines, Houghton, Michigan: Arthur Alexander Koch, Ph.D., University of Basel, instructor in Chemistry; Chas. Franklin Bowen, M.S., University of Wisconsin, and Eugene Thomas Hancock, B.S., University of Wisconsin, instructors in Geology and Mineralogy; Charles Hamilton Hoyt C.E., Thayer College of Engineering, instructor in Civil and Mining Engineering; Durward Copeland, B.S., Massachusetts Institute of Technology, instructor in Metallurgy and Ore Dressing.

The funeral of the late Mr. John F. Stairs, ex M.P. of Halifax, whose death we referred to in our last issue, took place on the 28th ulto., from his late residence, and was the largest funeral in Halifax for many years. The local press spoke of the cortege as the largest and most representative tribute to an honored fellow citizen paid by the men of all classes in Halifax "since the death of Howe," Nova Scotia's greatest son. Indeed, not only did his fellow townsmen, but men from every portion of "the Province by the sea" solemnly hasten to show to the world the honor and the respect in which they held the captain of industry and patriotic citizen who had gone, in the prime of life, and in the very zenith of his usefulness, to his last long rest.

An echo of the great explosion at Fernie, B.C., comes from England in the shape of an announcement from the North of England Institute of Mining and Mechanical Engineers that the Greenwell medal has been awarded to Mr. Wm. Blakemore for his paper on the Fernie explosion. We have been favored with a copy of the letter addressed to Mr. Blakemore, which we take pleasure in reproducing:—

North of England Institute of Mining and
Mechanical Engineers,
Newcastle-on-Tyne, September 29, '04.

Wm. Blakemore, Esq.

Dear Sir,—I have great pleasure in advising you that the Council of the Institute has awarded to you a G. C. Greenwell medal for your paper upon "The Fernie Explosion," and this medal will be presented at the general meeting of the Institute to be held on October 8th, and should you be unable to be present perhaps you would kindly depute some one to receive the medal on your behalf. I shall be pleased to act in that capacity should you so desire.

Yours faithfully,
M. WALTON BROWN, Secretary.

INDUSTRIAL NOTES.

The Canadian Copper Company has received a gold medal for its exhibit at the St. Louis Fair.

The Wetherill Separating Co., manufacturing magnetic separating machines, have received a gold medal from the St. Louis Fair. The Canadian agents of this company are Robert Gardner & Son, 40 Nazareth Street, Montreal.

The Chrome Steel Works, manufacturers of chrome steel shoes and dies, and other fixtures for gold and silver stamp mills, also welded chrome steel and iron plates for safes and safety vaults, who have been located in Brooklyn, N.Y., for a great many years, have removed to Chrome, New Jersey, where an extensive plant, covering several acres, has been installed. Parties who have dealings with the Chrome Steel Works will do well to make a note of the change.

Toronto has entered the field of locomotive manufacture. On the 25th inst. the Canada Foundry Co. turned out a large freight engine for the use of the C.P.R., which is one of many ordered by that company from the Canada Foundry Co. With the Toronto works turning out locomotives, the Locomotive and Machine Co., of Montreal, and the Kingston Locomotive Works, ditto, and the proposed works of the Grand Trunk Pacific Company and the Dominion Bridge Company, Canada will be in a position to fill more than local orders.

MINING NOTES.

NOVA SCOTIA.

Attempts are making by some English capitalists to open up the deposit of coal at Cochrane's Lake, Cape Breton.

The shipments of coal from the Cumberland Railway & Coal Company in the month of September were 37,933 tons.

The semi-annual meeting of the Mining Society of Nova Scotia will be held on Wednesday, November 9th, in the City Hall, Halifax.

Some parties at Barrasois, Cape Breton, are mining an ore consisting of specular iron and brown hematite, and which it is claimed averages over 60 per cent. metallic iron.

It is reported that a Halifax syndicate, which is already interested in mining at Cheticamp, has recently purchased the copper smelter formerly owned by the Copper Crown Company, at Pictou, N.S.

The Nova Scotia Steel & Coal Company has been authorized by its shareholders to make an issue of consolidated six per cent. gold bonds to the amount of $3,900,000, of which $1,500,000 will be offered at once.

The Londonderry Iron & Steel Company have purchased the iron deposits at Torbrook, N.S., and are resuming shipments to the furnaces at Londonderry. At present the output is running from 50 to 100 tons per day.

The Halifax Board of Trade has formed a Mining Committee with Mr. A. McNeil as chairman, and Mr. Weldon as secretary. At a meeting held on the 19th of October the secretary was instructed to procure copies of all mineral maps, plans and official data to be kept as records. The committee will collect detailed information regarding the iron ores and resources of Nova Scotia, as well as the ores of other metals found in abundance in that Province.

Writing to the Halifax "Herald," a correspondent suggests that in view of the deep interest shown by the late Mr. J. F. Stairs in the cause of education, he having been, in addition to filling many other high offices, president of the Board of Governors of Dalhousie University, that funds be raised for the endowment of a chair in Dalhousie to be called the "John F. Stairs" professorship. As the inauguration of the School of Mining in connection with the University was almost entirely due to his action, it would seem fitting that such endowment of a chair to bear the name of the lamented president, should be made; and the Review understands that steps are being taken by the friends of Dalhousie, and the friends and business associates of Mr. Stairs to so commemorate his life and work.

The shipments of coal made by the Dominion Coal Company, Ltd., in September amounted to 276,454 tons.

The outputs of the various colleries during the same month were:

	Tons.
Dominion No. 1	45,612
" No. 2	28,557
" No. 3	24,179
" No. 4	48,134
" No. 5	74,958
" No. 7	14,842
" No. 8	21,367
" No. 9	18,085
	275,734

NEW BRUNSWICK.

Recent attempts to locate graphite in the vicinity of St. John, N.B., are said to have been successful, the prospectors having come across deposits near the St. John side of the Falls bridge. The Review has not yet learned of the extent of the find, or of the probable outcome.

Mr. Frank Denton, K.C., of Toronto, has secured the lease of a large territory in New Brunswick, which is supposed to be oil-bearing. It lies in Albert County, on the south bank of the Petitcodiac River. Some four wells have already been sunk in this territory which have produced some oil, and the neighboring counties of Kent and Westmoreland are being exploited. We are informed that Mr. Denton and associates have secured abundant capital for the exploitation of their territory.

QUEBEC.

On the authority of Mr. Obalski, Inspetcor of Mines for Quebec, we announce that fine samples of asbestos have been found in the country west of Lake St. John near the head waters of the Nottoway River, about 190 miles from Roberval. The discovery was made by a Mr. McKenzie, and the asbestos fibre brought in shows a length of two, three and four inches.

Local papers have assumed the correctness of an item emanating from Sherbrooke, P.Q., to the effect that Mr. Henry M. Whitney, former president of the Dominion Coal Company, has purchased the asbestos mine owned by King Bros. at Thetford Station. The price reported is $1,500,000. It is a matter of current knowledge that the King mine has been on the market since the death of the late Mr. James King, and that it has been offered to English people for about $1,250,000. The rumor lacks confirmation.

ONTARIO.

The Redeemer Mine, near Dryden, is to have a 10 stamp mill which will be operated by water power.

The talc mines at Madoc are producing large quantities of the mineral, which is reported to be satisfactory in grade.

The students of the Kingston School of Mines recently spent four days in examining mining property in North Hastings and vicinity.

The Black Donald Graphite Mine, near Calabogie, which was flooded two years ago, has been pumped out by the Globe Refining Company.

The mica property of Mr. J. D. King, near Cantley, Ontario, has been sold to the Westinghouse Electric Company, of Pittsburg.

J. F. Black, of Sudbury, has sold a nickel-copper territory in Lavack Township to a syndicate of Philadelphia and Sault Ste. Marie people for $70,000.

It is reported that the Lake Superior Company are considering the possibilities of erecting a copper smelter for the sulphuretted ores of the Sault Ste. Marie district.

The Lake Superior Company started its coke blast furnace about the middle of the month, and is reported to be running satisfactorily; the charcoal blast furnace will go into blast shortly.

Power to the extent of 1,000 horse power is being developed on Moon River to be transmitted and utilized in the copper mines of the Parry Sound district; if there are any such mines worth developing.

The boundary line dispute between Mr. C. E. Smith and the Madoc Mining Company is reported to be settled, and operations will therefore be resumed at the pyrites mine which is at Bogart, Hastings County.

Our correspondent reports that the Baden Powell Gold Mine, on Eagle Lake, has enough ore on the dump to keep running a five stamp mill for twelve months, and that the Northern Light Mines Company is erecting such a mill.

Diamond drills are at work on the Temagami Iron property which belongs to Messrs. O'Connor, Caldwell and Mulock, and also on the property of the Lake Superior Company in Creighton Township which adjoins the Gertrude mine.

The discovery of oil on Manitoulin is not new; many years ago a company shipped several hundred barrels of oil which was obtained from a spring, or natural outflow, near the lake shore. The enterprise was abandoned on account of trouble with the Indians.

Reports from the Loon Lake iron district say that one bed is 20 feet thick and the other from 30 to 40 feet in thickness; the hematite analysis from 50 to 60 percent. metallic iron, with very low phosphorus. The better grade of ore is pronounced of Bessemer quality.

The Helen Mine, at Michipicoton, is now making an output of about 1,000 tons of iron ore each 24 hours. Open cast working is to be abandoned and mining done underground. The ore which is being produced is being shipped for the greater part to the United States to satisfy old contracts.

The Goldrock Mining & Milling Company, of Wabigoon, has been reorganized, and its head office transferred from Detroit to Columbus, Ohio. The president of the new company is Mr. Samuel L. Black, Probate Judge of Franklyn County, Ohio. The new management has not been named.

The Cook mine in Hastings County has had some ore tested at the Atlas Arsenic Company's mill, which gave a result of from $10 to $12 per ton. This yield is in excess of anything hitherto found on the property, and will yield a profit in gold outside of whatever profit may be realized from the arsenic.

A 3,000 electric horse power plant is being developed on the Vermilion River, fourteen miles west of Sudbury, by Ottawa gentlemen who have already expended upon it $100,000. Cochrane & McVittie are developing also a 4,000 horse power water power on the Wahnapitae River, thirteen miles from Sudbury.

The German-American Company which has recently been organized with a capital of $75,000, has secured rights on 2,000 acres of mineral lands in Burgess Township. The company is at present mining apatite or phosphate of lime of good quality, which it is shipping to Germany. At present some fifty men are employed.

A rich deposit of nickel is reported to have been discovered at Fort Matachewan on the Montreal River. This deposit is reported to be 20 feet in width and to intersect the course of the Montreal River. The mass has been stripped for some distance, and shows up well to a depth of 60 feet. The discovery is within the limit of the Temagami Forest Reserve.

In consequence of restrictions, on both land and water, regarding the carriage of high explosives, the Bullard Company (which is boring for oil in Manitoulin Island) is now erecting a nitro glycerine factory on the island. The drilling of holes is steadily going forward, and these holes will be plugged to be afterwards shot when the glycerine factory is in operation.

The Ontario Pipe Line Company has contracted with the Canadian Drilling and Development Co. to drill thirty wells in the counties of Lincoln, Haldimand and Welland, to be completed by the first of May next. The Ontario Pipe Line Co. is also to furnish Hamilton with a supply of natural gas which will probably come through the Pittsburg Syndicate operating at Dunnville.

The British American Development Co., operating a pyrites mine at Queensboro, Hastings County, is producing considerable quantities of iron pyrites. The deposit has a width of 20 feet, and the percentage of sulphur is high. Should a permanent market for the product be obtained steam machinery will be installed, and possibly the local manufacture of sulphuric acid be undertaken.

The Huronian Company, organized by Col. Robert M. Thompson, of the International Nickel Company, contemplates the installation of a large electrical plant at Turbine, on the Spanish River. The plant is to furnish power to be transmitted to the smelters of the Canadian Copper Company at Copper Cliff, which is only thirty miles away. The first installation will be of 6,000 horse power.

The opening of Corundum mines in Renfrew County by the Corundum Refiners, Limited, has caused quite an increase of population at the place where the company is erecting its new mill near Palmer Rapids. The village is called Jewelville, and a post office has been established. Contracts for some thirty houses for the workmen have been let, but the new mill will not be ready to operate before the spring of 1905.

The Chief Justice of Ontario has refused a compelling order to state a special case in the action of Rowell and Mitchell vs. The Consolidated Lake Superior Company in order that the case could be reviewed in a higher court. Judge Johnston, as referee, had given the plaintiffs $119,000 damages for being dispossessed of the Helen Mine, of which Rowell and Mitchell were lessees. In consequence of the Chief Justice's refusal the award for damages stands.

The Craig Mining Company at their mine near Marmora, has put in a Rand air compressor of the capacity of sixteen drills, together with boilers and other necessary machinery for vigorously pushing work at the mine. The vein is from 12 inches to 13 inches wide at the bottom of the shaft, and it is reported that values increase as depth is attained. The principal shareholders live in Newark, N.J.; Mr. W. A. Hungerford is the local manager.

In the case of Stephens vs. Flint Lake Mining Company, the Court of Appeal has dismissed the appeal of the defendants. The defendants constitute an extra provincial company carrying on operations at Flint Lake, and the verdict recorded against them in the District Court of Rainy River amounted to $1,302.73 for work and materials. The Court of Appeal has given them the right to apply to the District Court to reduce judgments by such sums as may have been returned.

The current newspaper articles which speak of the possibility of the United States Steel Corporation establishing a plant in Canada have lent some credence locally to the belief that the Northern Iron & Steel Co. will be purchased by the U. S. Corporation. It will be remembered that the Northern Iron & Steel Company is the name of the concern which recently bought out the old Cramp Steel Works at Collingwood. The rumors are too vague and indefinite to stamp anything as authentic at the present time.

Reports upon the Eagle Lake gold district are promising, according to Mr. W. E. H. Carter, Provincial Inspector of Mines. The properties lie on the west end of Eagle Lake, and results running as high as $40 per ton have been obtained from selected ore run through a two stamp mill. The quartz veins of this area are confined to a granite formation lying on the southeast side of a contact with greenstone; the quartz veins in the trap on the northwest side of the contact have not shown gold in paying quantities.

An echo of the Charbonneau scandal is heard in the action which has been entered at Toronto by the Banque Broquard, of Paris, France, on behalf of itself and the shareholders of the Gold Run Klondike Mining Co. against the Canadian Gold Mining Concession Co. of Ottawa, and Madame Belinda Charbonneau, of Dawson City. The action asks for a declaration that the claim known as the Creuger Concession, granted in 1900, is the property of the Gold Run Klondike Mining Company. Creuger, who discovered the claim, assigned his interest to Madame Charbonneau, who reassigned it to the Canadian Gold Mining Concession Company. The Banque Broquard affirm that Madame holds it only as trustee for the Gold Run Klondike Company.

The following mining leases, heretofore granted in Ontario, have been cancelled under section 36 of the Mines Act:—

Lease dated 13th September, 1900, to Ernest E. Gatensburg, of Rat Portage, for mining location M. H. 324, being an island in Eagle Lake, in the District of Rainy River, for the term of ten years.

Lease dated 26th September, 1900, to Ernest E. Gatensburg, of Rat Portage, for mining location M. H. 257, being land under the water of Eagle Lake, east of mining location M. H. 257, in the District of Rainy River, for the term of ten years.

Lease dated 13th September, 1900, to Ernest E. Gatensburg, of Rat Portage, for mining location M. H. 323, on the shore of Eagle Lake, in the District of Rainy River, for the term of ten years.

BRITISH COLUMBIA.

It is rumored that the Whitewater and Whitewater Deep mines are to be amalgamated.

The Great Northern Railway is now taking 500 tons of coal daily from Fernie, and 350 tons daily from Morrisey.

The year's clean up of the Consolidated Cariboo Hydraulic Company is reported at the disappointing figure of $85,000.

The Bluebird Mine at Sandon has started to stope ore; the mine has a reserve of rich ore which is to be taken out at once.

The old Jumbo mine, near Rossland, made a strike of rich ore in one of its levels during the month; its extent is yet unknown.

Mr. A. H. Kelly, manager of the Reliance Mine on 49 Creek, near Nelson, reports the mill of the company as nearly completed.

Local papers state that the Byron N. White Company (Slocan Star) will build a zinc concentrator at Nelson.

An unexpected strike of high grade galena is reported from the Foghorn mine, near Ymir. The width of ledge is given at eight feet.

The Canadian Smelting Works at Trail will secure water for the smelter from lakes in the vicinity of Rossland at an expense of from $8,000 to $10,000.

The C. P. R. has surveying parties along the Columbia River between Golden and Fort Steele, endeavoring to obtain a location line for the Kootenay Central Railway.

Ymir is becoming quite a stamp-mill town; there are fifty stamps dropping at the Ymir mine, ten at the Queen, four at the Wilcox with another ten to be erected, ten at the Second Relief, and ten at the Porto Rico.

The Oyster-Criterion mill of the Great Northern Mines, Ltd., cleaned up a gold brick of the value of $4,000, as the result of one month's run. It is reported that the company is to add ten stamps to the existing mill.

The Phoenix branch of the Great Northern Railway is being rapidly pushed, the contractor having over 1,600 men on his pay roll. The rails were laid to the Granby smelter by the 15th inst., and ballasting is now going forward.

Estimates for this year's output of the Boundary district, based on the tonnage for the last nine months, are put at 800,000 to 850,000 tons, of an average value of $5.00 per ton. This would give a gross yield of $4,000,000 to $4,250,000, against $3,654,000 for 1903.

Reports from the Paradise Mine, Wilmer, B.C., are to the effect that shipments of lead carbonates are steadily going forward. On No. 4 level a good bunch of concentrating galena ore has been found, of which the galena carries very high values. The erection of concentration works is under consideration by the owners.

The early locations of the "Two Friends" and "Black Prince" in the Slocan district have now been consolidated for about one year, and the development work done has shown some high grade galena on the Two Friends. New management and additional funds have produced a showing quite satisfactory to the shareholders.

A Nelson correspondent sends the improbable story that Edinburgh capitalists are subscribing $100,000 for the purpose of building a 100 ton smelter at Slocam City, that freight and treatment charges on the ore to the Hall or Trail smelters may be reduced. We fancy more than $100,000 will be required for any such purpose.

The Lucky Jim Mine during the month completed a shipment of 1,000 tons of zinc ore to the Kootenay Ore Co., at Kaslo, which averaged between 50 and 60 per cent. of metallic zinc. At a time when zinc is bringing five cents per lb. against 2½ cents per lb. for lead, Kootenay ore mines are not likely to neglect their chances.

The concentrating plant of the Alice Company at Creston is completed. The ore comes over a Riblet tramway from the mine to the mill ore bins, whence it is delivered to a Blake crusher and Gates rolls. From the rolls it passes through three revolving screens of different mesh and the product is fed to jigs. The undersize is fed to a classifier then to spitzkasten, and finally to Overstrom tables.

The Bulkley River in the Babine Range, near Babine Lake, is one of the most recent booms attempted in B. C. Reports are received to the effect that bituminous coal, gold-bearing copper minerals and free gold are to be found in abundance. The coal is largely owned by the Cassiar Coal Company, and the suppositious choice of the Grand Trunk Pacific for the Bulkley Valley is the probable basis for the boom.

The Hunter V. Mine, in consequence of the contemplated erection of a crushing and concentrating plant have been obliged to build a waggon road from Porcupine Creek to the mine. Among the possibilities are the installation of an electric power plant to drive the machinery and to be operated by the water-power of Porcupine Creek. Mr. R. W. Brigstock, the superintendent, has been engaged in making the necessary surveys.

A discovery of some importance to B. C. was made early in the month at Matsqui, near Vancouver. A Mr. F. S. Maclure, when digging in the side of a hill slope, came upon a body of blue clay, of fine texture and plasticity, the analysis of which corresponds closely with that of the best English fire clays. Should the burning tests show the clay to be free from shrinkage, cracks and fluxing. B. C. will have a local source of supply for all refractory material needed.

The Imperial Coal & Coke Company, whose areas are on Fording River, a tributary of the Elk, have been working twenty men, under the superintendence of Mr. W. R. Wilson, for several months past, chiefly in exploring the outcrops. This company is putting in a winter camp for tunnelling work. Seventeen seams of coal have been uncovered, ranging from four to thirty feet in thickness, and the tests are said to be satisfactory. This property adjoins that of the C.P.R., and if the latter should construct a branch line it will serve both.

The Standard Mining Co., operating the Hunter V. Mine at Ymir, have decided to put in a concentrating plant in consequence of a change in the character of their ore. The mine belongs to a Nelson syndicate, and was financed in Montreal and Scotland. The ore is low grade, but of enormous extent. It is worked as a quarry, and values have ranged from $3.50 to 4.00. Recently the ore has become more silicious and the values have increased, hence the proposed change in the method of handling At present the ore is shipped in bulk, either to the Hall mines smelter or to Granby; the tonnage shipped is about fifty tons a day.

The C. P. R. have done a considerable amount of development work on their coal claims on the Upper Elk River, fifty to sixty miles north of Fernie. The result of the season's work will shortly be known, but from the fact that surveys have been made for a branch line from Michel it is reasonable to conclude that the first promise of this important find has been fulfilled. A winter camp has been established and work will be continued in the several tunnels which have been started. The seams are, in the opinion of experts, a continuation of Fernie seams, and as was expected the coal at the face of the tunnels is cleaner than the first samples taken from the outcrops. Several recent analyses give as low as seven per cent. in ash, and may still improve, in which case clean coke is assured.

YUKON.

The Yukon filled with ice on the 24th of October, and navigation for 1904 has closed.

Application for 2,000 inches of water from Australia Creek has been made by the Gold Run Klondyke Company, for use on its properties situated on the right limit of Dominion Creek.

The first ice seen this fall in the Yukon was noticed on Sunday, the 18th of September. The first ice in 1903 was seen on October 13th, thus making this fall season nearly a month earlier than last year.

Press reports credit R. G. McConnel, of the Geological Survey, with the statement that the Mount St. Elias range, in the Western Yukon country, will be found to contain valuable gold deposits.

The purchase price of Gold Hill claims sold by A. B. Palmer to the White Channel Gold Hill Hydrau..cs, Limited, is stated to have been $562,500.00. The new company has a capital of $575,000.00, and the inference is that the bulk of the price was paid in shares.

The Norwood ditch on upper Bonanza has been completed. Siphons have been employed in crossing all the depressions, thus saving length of ditch. These siphons are made of sheet steel, twenty-four inches in diameter. The head afforded by the ditch is four hundred feet .

The new Government road on Sulphur extending from 31 to 80 below, a distance of about five miles, was finished Sept. 15th, and will be a great convenience to the miners of Lower Sulphur, who have been practically isolated in the summer so far as getting supplies, etc., to their claims.

A correspondent of the Vancouver "News Advertiser" writing from White Horse, makes use of the worn excuse that miners are leaving the Yukon because legislation is "unfair;" legislation in the territory may be inadequate, or it may be corrupt, but it is as "fair" for one man as another.

A new road is to be built on Clear Creek, from Barlow to Discovery, a distance of about fifteen miles. Clear Creek is the worst creek in the Yukon District for overflowing its banks, causing the necessity of wading waist deep in midwinter. During the summer months supplies are taken in via steamer to McQuestion, a distance of about 24 miles, and then packed across on horses when the trail is hard and dry, at a cost of from 10 to 11 cents a pound.

Figures obtained from the comptroller at Dawson show that so far in 1904 royalty has been paid on $8,500,000 of gold sent out, or exported. These figures do not include Forty Mile nor White Horse districts, returns from which for September had not been received. The gold exported thus far is as follows:

January	$85,895.55
February	107,417.10
March	138,740.40
April	60.00
May	836,606.10
June	2,697,598.70
July	1,300,250.55
August	1,539,518.40
September	1,887,646.80
Total	$8,593,733.60

FOREIGN.

For the month of August, the consumption was 9,352 tons against 6,150 tons for August, 1903.

The Finnish asbestos industry is confined to three or four deposits situated in the centre of Finland.

The German consumption of foreign copper for the first eight months of 1904 was 68,872 tons, an excess of 19,742 tons over the same period for 1903.

The amount of iron ore to be forwarded from the Lake Superior mines this season will reach 20,000,000 tons, some 8,000,000 tons less than the record in 1902.

The yield of gold from the Rand for the month of September totalled 312,286 ounces, valued at $6,632,500.00, which is practically the same as for the month of August. The importation of coolie labor does not seem to have been productive of results as yet, though its effects are looked for very shortly.

COAL NOTES.

The shipments of the Dominion Coal Company for the nine months ending September 30th, 1904, aggregated 2,354,779 tons, as against 2,418,128 tons for the same period in 1903.

During the first nine months of this year the receipts of coal at Boston from Great Britain amounted to only 401,958 tons; in 1903 for the same period Boston imported 1,074,035 tons.

Dominion No. 1 colliery made almost a record output this month; in one day's work there were 2,300 tons put out, which is the record since the fire, and nearly up to the record before the fire occurred.

Construction work on the Fernie and Morrisey branch of the great Northern Railway has uncovered forty feet of coal on the Morrison claim, near Morrisey, B. C. The land is owned by the Western Oil and Coal Company of Vancouver.

The International Coal & Coke Company is now producing over 500 tons per day. The work now nearing completion will enable an output of 4,000 tons daily to be handled if such an amount should ever be needed. The bulk of the output now making is sold to the Canadian Pacific Railway.

The anthracite mines near Banff, Alberta, are shipping about 300 tons daily; of this amount 200 tons are of sizes larger than nut, and 100 tons are of smaller size. Between 400 and 500 men are employed at the mines, but the majority of these are tradesmen used in construction work. The bulk of hard coal shipments go to the Province of British Columbia.

Operations at the collieries of the French company operating at Blairmore, B.C., were discontinued on the first of October in compliance with peremptory orders from Paris. The announcement was a surprise inasmuch as large amounts of French capital have been invested, and the property was doing well. It is surmised by the officials at Blairmore that orders to suspend operations are the result of an internal disagreement among the officials of the company in France, but no authoritative reason has leaked to this side.

NEW COMPANIES.

ONTARIO.

The Niagara Quarry Company Limited. Head office, Orillia, Ont. Capital, $40,000. Provisinoal directors:—James Brockett Tudhope, William Hugh Tudhope, William Thompson, George Thompson and Andrew Craig of Orillia.

New York Lake Erie Oil & Gas Company, Limited. Head office, Windsor, Ont. Capital, $1,000,000. Provisional directors:—John Wurtele Lovell, Alice Wurtele Lovell, Alfred Henry Clarke, Alexander Robe. Bartlet and Agnes Waldie McGregor, Windsor.

The Canada Process Company, Limited. Incorporated 5th of October, 1904. Capital, $50,000. To manufacture products from all kinds of metals, minerals or compositions. Head office, Toronto. Provisional directors:—George L. Sherlock, James M. Neil and George H. Campbell.

The Senator Mill Manufacturing Company, Limited. Incorporated 28th of September, 1904. Capital, $100,000. To manufacture machinery for the reduction and manufacture of rock ore, quartz, cement and other refractory substances. Head office, Toronto, Ont. Provisional directors:—James K. Griffin, John Ridley and William St. Clair

The Canadian Lead Company, Limited. Head office, Toronto, Ont. Capital, $1,000,000. Provisional directors:—William Henry Eccles, Harry Arthur Bouter, John Henry Vamplew, Neil Sinclair and Frank Morison, Toronto, Ont.

Ballarat Mining Company, Limited. Head office, Toronto. Incorporated 5th of October, 1904. Capital, $300,000. Provisional directors:—James Stellar Lovell, William Bain, Robert Gowans, Ernest McNeil and Richard Richardson.

The Crown Oil Company, Limited. Head office, London, Ont. Capital, $300,000. Provisional directors:—D. S. Robb, London, Ont.; Clara McDowell. B. I. Baker, Josephine W. Brake, of Buffalo.

The Northern Construction Company Limited. Incorporated 7th Sept., 1904. Capital, $200,000, in shares of $100. Head office, Toronto, Ont. Provisional directors:—Alex. R. Mann, Archibald Cameron McKenzie, Wm. Henry Moore, Francis Annesley and Albert Mitchell, Toronto, Ont.

The following companies have been granted Provincial licenses:

The New River Consolidated Coal & Coke Company, incorporated in New Jersey, with T. W. Holistead, of Toronto, attorney.

Minnehaha Mining & Smelting Co., incorporated Arizona. Hugh Dalston, of Wabigon, attorney.

Big Master Mining Company, incorporated in New York. Philip Edward MacKenzie, of Rat Portage, as attorney.

BRITISH COLUMBIA.

The Revelstoke Land Company, Limited. Incorporated 23rd September, 1904. Capital, $50,000.

Greenwood Strathmore Mines, Limited. Incorporated 22nd September, 1904. Capital, $150,000.

Digest of Recent Patents: Mining and Metallurgical.

CANADIAN.

Sept. 20, 1904.

770,286.—Mining Machine. William E. Hamilton, Zanesville, Ohio. A mining machine comprising a movable platform, a radial frame pivotally mounted on said platform, cutting mechanism and breaking mechanism mounted on the forward end of said frame, and loading mechanism movably mounted on said movable platform and detachably connected at its forward end with the forward end of said frame in such manner that the said loading mechanism projects beneath and moves with said breaking mechanism.

770,624.—Gas Producer. Walter O. Amsler, Pittsburg, Pa., assignor to The Amsler Engineering Company, Pittsburg, Pa. The combination with the combustion-chamber, of a water-sealed trough below the combustion-chamber, a centrally-disposed cylindrical casing extending upwardly from the bottom of the trough, and a series of gratings supported by the cylindrical arranged in the form of a hollow frustum of a cone.

770,498.—Mine Car. William E. Hamilton, Zanesville, Ohio, assignor to Hamilton Manufacturing Company, Columbus, Ohio, a corporation of Ohio. A mine car comprising side and end walls, one of said walls having an opening therein, adapted to receive a part of a loading-machine, and means on said wall normally projecting into said opening to engage said part to couple said car and loading machine together.

770,289.—Amalgamating Machine. Frederick J. Hoyt, Chicago, Ill. The combination with a bowl, mercury therein, a semi-submerged body floated in said mercury, held centrally in said vessel, but unsupported, at its axle ends, of a charging spout over said body.

770,503.—Process of Forming Coal Briquets. Eli H. Larkin, St. Louis, Mo. A process which consists in mixing approximately three per cent. of crude petroleum with about ninety-seven per cent. of coal slack, then adding starch paste in about the proportion of two pounds of starch in paste form to suhstantially one hundred pounds of the petroleum-treated slack, and finally pressing the mixture into lumps or blocks.

770,283.—Ore Concentrator. Abel Guionneau, Denver, Col., assignor of two-thirds to Charles M. Fueller and Robert J. Cory, Denver, Col. A reciprocating table-concentrator, a flat, smooth tahle surface provided with several rows of inverted conical cups extending from the head-end portion of the table throughout a portion of each table's length, each row of cups connected together with a sunken groove or riffle.

770,561.—Switch-off Device for Endless Conveyors. Frederick O. Crowley, Oswego, N.Y. In combination with an endless conveyor, a guide or switch-off device upon or in close proximity to the conveyor, and having an inlet in one end for receiving the articles to be fed and its other end deflected laterally to the sides of the conveyor whereby the articles are fed by the belt from the inlet and diverted from the belt by the guide.

Sept. 27, 1904.

771,025.—Manufacture of Zinc White. Jacques Oettli, Lausanne, Switzerland, assignor to the firm of Syndica pour l'Exploitation des Inventions du Professeur Oettli, Berne, Switzerland. A process which consists in subjecting zinc plates to the action of electrolysis in a solution of one per cent. sodium sulphate of a temperature of approximately 60 C., obtained by means of a current of ten amp. per square decimeter.

771,107.—Ore Washing or Concentrating Machine. Enos A. Wall, Salt Lake City, Utah. An ore-concentrating machine or table adapted to receive actuating impulse from the head end, in combination with an operating rod or bar attached to the head of the table a buffer-bar through which the rod passes, a spring on the rod at the inner side of said buffer-bar and a buffer-hlock secured to the rod or bar at the outer side of the buffer bar or timber to receive and resist the impact of the spring and suddenly stop the forward movement of the table at its head end as it moves in the direction of the tail, and means for retracting the operating rod against the spring and suddenly releasing it.

770,796.—Apparatus for Separating Ore. Henry F. Camphell, Boston, Mass., assignor by direct and mesne assignments, to National Magnetic Separating Company, a corporation of Maine. The combination in a magnetic separator, of a magnet: means, presenting an unobstructed surface at a due distance below the magnet, and through an uninterrupted field of such magnet, and to pass it, spread in a film of substantially uniform thickness on the surface beneath the magnet, and means for causing the particles of ore to be mechanically agitated under the magnet in a direction other than that of travel of the ore.

770,910.—Cooling Device for Blast Furnaces. Ludwig-Keyling, Berlin, Germany. The combination of a box in which the upper opening of the furnace is situated a plate situated in this box vertically above the upper opening of the furnace, the diameter of this plate being larger than the upper opening over the opening of the furnace, a water nozzle situated vertically above the plate, an annular channel situated around the top part of the furnace in the box and means for connecting this channel with the outside.

771,058.—Method of Extracting Moisture from Air for Blast Furnaces or Converters. James Gayley, New York, N.Y. The method of feeding the air-blast to blast furnaces or converters which consists in feeding the air into a refrigerating chamber, distrihuting it therein in a current directed successively in varying directions, artificially cooling the air in the chamber to reduce its moisture to a small percentage, supplying the dried air to a blowing machine and feeding the dried air therefrom under compression into the furnace or convertor.

Oct. 4, 1904.

771,277.—Process of Concentrating Ores. Alice H. Schwarz, New York, N.Y., assignor to Schwarz Ore Treating Company, a corporation of Arizona. A method which consists in mixing a melted fatty matter which is solid at normal temperatures with the ore, then solidifying the fatty matter and separating the gangue from the values entrained in the fatty matter while the latter is solidified.

771,454.—Apparatus for Extracting Gold from Auriferous Sand, etc. Robert Blake, Madison, N.J., assignor to Eliza Blake, Madison, N. J. The combination with a tank adapted to contain a lower body of mercury, and having a discharge located in a relatively elevated plane of a horizontal cylinder transversely within said tank, and adapted to have its lower portion immersed in the mercury, provision for supplying material to the tank, in front of the cylinder, a pivotally-suspended arm depending within the upper portion of the tank at the rear of the horizontal cylinder and between the latter and the discharge, said arm provided with a series of teeth extending transversely across the tank, the length of the arm and teeth conjointly being such that the teeth in their lowest position will be above the mercury, and means for actuating said cylinder for immersing the material in the mercury and causing said material to pass beneath the cylinder, and for oscillating the arm for causing the teeth to move back and forth in the path of an arc solely above the plane of the mercury surface.

771,646.—Process of Obtaining Metals. Franz von Kugelgen, Holcombs, Rock, Va., and Heinrich Danneel, Breslau Germany, assignors to the Willson Aluminum Company, New York, N.Y., a corporation of New York. A process which consists in electrolyzing a haloid of an alkali in the presence of an oxid of metal, thus obtaining the metal, an oxid of the alkali and the halogen, and maintaining a supply of the haloid and the oxid by adding fresh quantities thereof as they are decomposed.

771,684.—Dumping Car. Swan F. Swanson, Pueblo, Colo. The combination of a car body provided with an outlet, a door closing said outlet and carrying a stiffening-strip having extended portions, sliding pivoted catches to engage said extended portions to hold the door closed, a crank shaft for actuating said catches, and means for actuating the crank shaft.

771,438.—Conveyor. Thomas McDonald and Willie McKee, Youngstown, Ohio. A conveyor, two movable frames, each frame having a set of supports for the material being conveyed, and means for effecting a curved movement of each frame for the purpose of giving a positive forward motion to the material being conveyed.

Oct. 11, 1904.

771,994.—Drying Apparatus. Frederick Meyer, Chicago, Ill. A drier comprising a rotary drum having two annular rows of shelves secured within same, one of said rows being disposed nearer to the centre of the drum than the other, the inner row having two alternating sets of shelves, the shelves in one of said sets being disposed radially of the drum, and the shelves of the other set being disposed tangentially, the shelves in the outer row being spaced from the shelves in the inner row to permit the contents of the drum to be dropped from the outer shelves to the inner shelves and to return to the outer shelves through the revolution of the drum.

771,872.—Furnace for the Manufacture of Steel. Gustav Gin, Paris, France. A furnace structure, and a hearth inclosed by and movable relatively to said furnace structure, the hearth having two non-carbon electrodes to connect it with a source of electrical energy and having an open channel in which the iron is placed to be treated while at rest, the electrodes being the terminal points of the channel.

771,857.—Pneumatic Gold-Separator. William Broadbent, Salt Lake City, Utah. The combination with the tank of two side casings with feed openings therein, a depression provided with an opening and closure therefor in the bottom of each side casing, a shaft extending through the side casings and tank carrying adjustable conveyor-blades within the side casings, sprocket-wheels on said shaft for driving it from a second shaft, and carrying perforated buckets, and means for delivering short puffs of air within the side openings near the bottom of the depressions.

771,909.—Mineral or Ore Washing Jig. Charles J. Hodge, Houghton, Mich. The combination of a driving shaft, a pair of eccentrics through which said shaft passes, and which are adjustable transversely of said shaft, a fly-wheel mounted on said shaft between said eccentrics and a crank connection between said fly-wheels and each of said eccentrics.

772,152.—Coal Mining Machine. Joseph F. Joy, New Eagle, Pa. A mining machine, a stationary frame comprising channel-beams and angle irons arranged there below, and frames connected to said beams and irons, a frame slidingly mounted on said stationary frame composed in part of centrally arranged angle irons, the bases of which slidingly engage said end frame and the webs of which form supports for the means whereby the same may be driven.

772,041.—Dump Car. **Frank K. Hoover** and Arthur J. City, Mo. The combination with a truck and an inclined track or way mounted thereon, of a car body, and a single pair of wheels journalled on opposite sides of said car body respectively and in the same vertical plane transversely of the track, said wheels being mounted and arranged to travel on said track or way and forming a moving pivot on which the car body may tilt.

771,833.—Apparatus for Mercurial Alkaline Processes. Charles W. Roepper, Germantown, Pa., and Willis E. Harmon, Mechanics Falls, Me., assignors to American Electrolytic Company, a corporation of Delaware. The combination of an amalgamating compartment; a demalgamating compartment; a main partition between the two, and a passageway under the partition; the bottom of the amalgamating compartment sloping downwardly from this passageway toward its other end.

Oct. 18, 1904.

772,846.—Gas Seal for Metallurgical Furnaces. Samuel Stewart, Brighton, and Harry Hughes, Woodward, Ala. A gas seal for metallurgical furnaces, comprising a plurality of sliding gates tapered at the ends to fit snugly together when in the closed position, a series of shafts geared together, and a crank on each shaft pivotally connected to one of said gates, and means for rocking one of said shafts.

772,699.—Ball Grinding Mill. Meter J. Davidsen, Copenhagen, Denmark. A ball grinding mill, consisting of a drum provided at some distance from its ingoing end with a row of openings, a screen extending beyond said row of openings and beyond the opposite end of the drum, a deflector on the shaft of the drum adjacent to the head of the same, apertures in said head adjacent to the deflector for returning the tailings for regrinding them in the end of the drum opposite to the ingoing end without mixing them with the material fed at the ingoing end of the drum.

772,472.—Filter-Press. James W. Neill, Salt Lake City, Utah. The combination of a cylinder adapted to contain the material to be filtered, a plunger working therein, means for reciprocating the plunger, means for reciprocating the cylinder, a valve controlling the passage of the material to be filtered to the interior of the cylinder and means actuated by the plunger for opening and closing said valve.

772,569.—Conveyor. Orlando Kling, Denver, Colo., assignor of one half to Herbert George, San Francisco, Cal. A conveyor, in combination, moving trucks or supports, receptacles movable independently of and mounted upon said supports or trucks, means for automatically tilting the receptacles while moving, and means co-operating with the bodies of the moving trucks or supports during their travel to prevent tilting thereof during the tilting movement of the receptacles.

772,723.—Blast Furnace. Andrew Latto and James C. Callan, Braddock, Pa. The combination with a blast furnace, of a conduit communicating with the blast furnace near the top thereof, and a dust-collector composed of a curved elbow, a downwardly-extending tube, angularly disposed plates arranged in said elbow and having spaces between the plates communicating with the open air.

772,389.—Ore Drainage and Leaching Tank. Jean F. Webb, Denver, Colo. A metallurgical filter, an outer imperforate tank separated by an annular space from an inner drainage and leaching tank with perforated sides and bottom covered with suitable filters, and having within its circumference the perforated lower end of a hollow compartment or stand-pipe, through which liquids or compressed air may be introduced into said tank and forced by pressure to pass outwardly through the filters and perforations thereof, and having pipes through which the flow of such liquids or compressed air may be reversed from the said hollow compartment or stand-pipe into the said annular space and be forced by pressure to pass inwardly through the perforations and filters of said tank.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills, who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licences to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly, either by arrangement with the owner or by arbitration, all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

PROVINCE OF QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles and the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mining of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals, and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in surveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds: Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P.Q.

Dominion of Canada.

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output

QUARTZ

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within 15 days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permisson may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location

PLACER MINING

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee $5, renewable yearly On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000

DREDGING IN THE YUKON TERRITORY

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental $100 per mile for first year and $10 per mile for each subsequent year Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be made within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one-half per cent. on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200

A certificate that work has been done must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM

All unappropriated Dominion Lands in Manitoba, the North-west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre, subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior.

OTTAWA, February, 1904

JAMES A. SMART,

Deputy of the Minister of the Interior.

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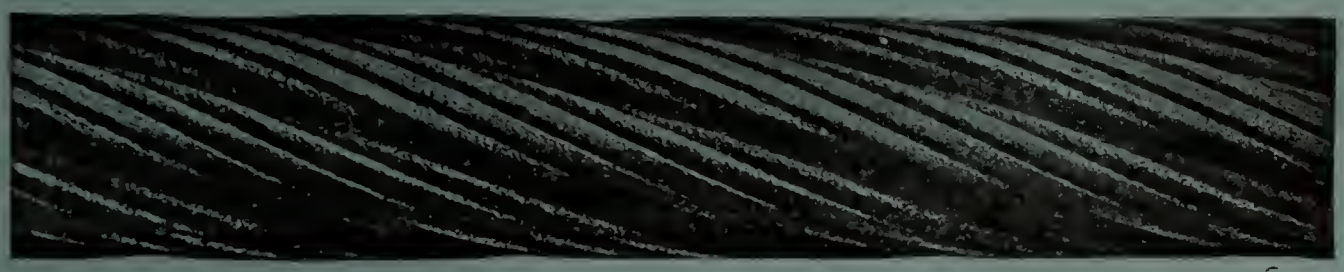

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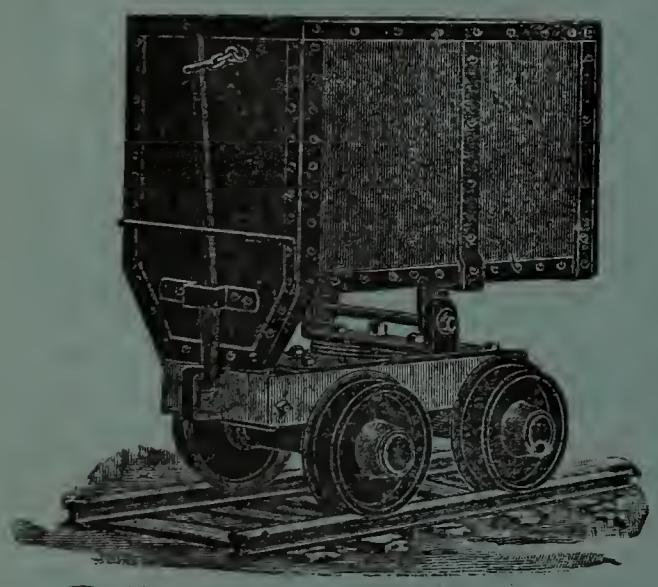

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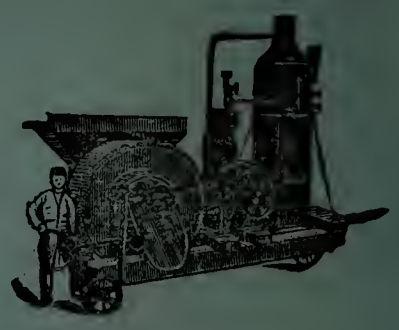

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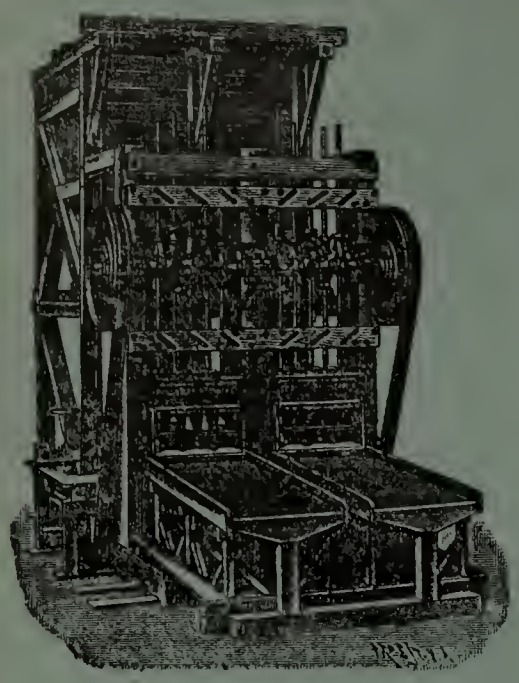

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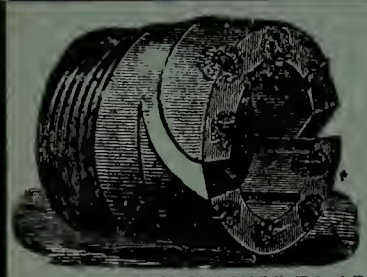

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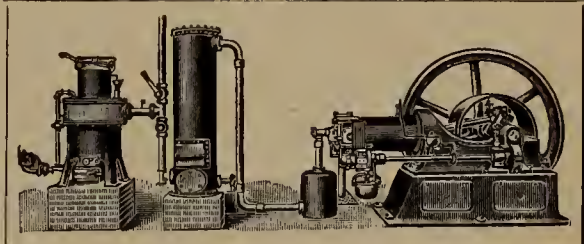
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CONTENTS.

The month of November has brought to notice nothing of importance concerning the proposed amalgamation of the Le Roi, War Eagle, Centre Star and Snowshoe properties, unless it be the addition of Mr. Carl R. Davis to the list of men now examining the Snowshoe mine. Mr. A. J. McMillan has made no statement and the presence of Mr. Geo. S. Waterlow on this side of the water has occasioned no public pronouncement.

In well-informed circles there is a strong belief that Mr. McMillan is not likely to remain long in the position of managing director, or general manager, of the Le Roi, and should the amalgamation become *un fait accompli*, it is not unlikely that several resignations will be asked for if they are not tendered. That a strong amalgamation of Rossland properties would be a successful undertaking is believed by all who clearly apprehend conditions in that camp, and such an amalgamation could not afford to continue the works at Northport. Either the acquisition of the Trail works or a new smelter on *this side of the line* would be a *sine qua non*. At any rate, matters will not drift for long as they are now doing, either the principal mines will be merged, or present options will be voided before the snow leaves.

The Senior Official Receiver in the Liquidation Court of England mentions our old acquaintance, the Sapphire Corundum Company, as "an interesting example of the inflation of capital," and gives the following figures: The company was registered with a capital of £1,000,000 stg. It bought from the promoters, Mr. E. J. Hooley and J. Carling Kelly, the property of the Crown Corundum Company for the sum of £900,000. The two gentlemen named bought what property this latter concern had for the price of £15,000 in cash, and £30,000 in shares. Thus does the modest sum of $75,000 become magnified to the figure of $5,000,000.

Sometime since, the mining journals of the country, and of the world, in fact, hailed the increased yield of gold due to the introduction of tube mills into the practice in South Africa as new discoveries which would revolutionize general practice and greatly increase the gold production of the world, which Mr. J. H. Curle believes to be at about its maximum, if not on the decline.

The practice of re-grinding which is the essential element of the tube mills, is not new in gold metallurgy; in its essence it has had numerous devices and machines at work for many years, from the horizontal pan with its dragging mullers, or the arrastra, to the modern long horizontally revolving cylinders filled with chilled balls or flints. It is only the device for finer grinding and not the principle that is new.

The attention of our readers is called to the letter of Mr. J. Obalski on another page. This announcement of the Provincial Inspector of Mines is authoritative and should attract prospectors and capitalists to the possibilities of that vast and little known region, Northern Quebec. The information should also be of great interest and importance to the Dominion Government and its new Railway Commission; for the location of the line of the new transcontinental railway must be made with a view to obtaining all possible traffic that may in the future exist in this northern country.

If large and workable deposits of copper ore and magnetite are shown to exist, the basis of permanent traffic is assured; if, in addition, gold, asbestos and merchantable timber are available, the line eastward, from Winnipeg to Moncton, will not be the "dead horse" which some of our Conservative friends have predicted.

Apropos of the interest taken in Canada in the appearance of the Government Commission's report on the subject of the electric smelting of iron ores, it is, perhaps, pertinent to remind our readers of the fact that Canada is already pretty well supplied with iron works. On the 30th of June, 1904, there remained unsold pig iron with Canadian manufacturers to the extent of 36,868 tons as compared with 13,585 tons on hand June 30th, 1903. Of this 36,868 tons over 32,000 were coke pig iron. On the date mentioned Canada had 15 completed stacks, of which 6 were in blast and 9 were idle; of the total of 15, only 4 were built to make charcoal iron.

The Dominion Iron and Steel Co. have four stacks at Sydney. The Londonderry Iron and Mining Co. have two at Londonderry, N.S. The Nova Scotia Steel and Coal Co. have two, one at Ferrona, N.S., and the other at Sydney Mines, C.B. The Canada Iron Furnace Co. have one at Radnor Forges, Que., and another at Midland, Ont. The Hamilton Steel and Iron Co., Hamilton, Ont., have one. The Deseronto Iron Co., at Deseronto, Ont., have one, and John McDougall & Co., of Montreal, have two stacks at Drummondville, Que. In addition we have the two stacks of the Lake Superior Corporation at Sault Ste. Marie.

What the possible output of Canada would be, were all the stacks in blast we do not know, but it would be far in excess of the demands of the country at the present time. Therefore, it does not seem to us that there is any crying need for the inception of new iron making enterprises in this country at present.

The Bankhead Collieries, Alberta.

Due credit is not always given to large public corporations for the possibilities which they convert into realities, and for the consequent inception of a host of minor enterprises which, but for the work of the large corporation, would have no existence. Of such a character has been much of the work of the mineral department of the Canadian Pacific Railway, especially typified in the recent rapid opening of the coal fields in the vicinity of Banff.

Residents of the west have commonly regarded the Railway as a soul-less corporation, whose only aim was to extract all possible from the miner, rancher, and farmer without causing his death or departure, and have forgotten, or have not recognized, that high tariff rates were a necessity until the volume of business guaranteed an income at least equal to the outgo. To get this volume of business is the first object of any railway through a sparsely populated region, and to induce settlement and increase population, the C. P. R. have expended millions throughout Western Canada.

The purchase and operation of the Trail smelter, with the consequent installation of a lead refinery and corroding works, was among the large earlier expenditures of this corporation; for this purpose more recently (this year, in fact) was incurred the expenditure of nearly a million dollars, and the employment of 500 men, to open up the extensive deposits of coal which outcrop along the southeastern base of Cascade Mountain. We print below a brief description of the geological features of the section from the pen of Mr. J. M. Turnbull, B.A. Sc., and preface his notes with some data to which he has not referred.

In the autumn of 1902, some prospecting work was done on the croppings of coal seams which showed on the south and southeast sides of Cascade Mountain, some three miles northeast of the station at Banff. This work showed the existence of a score of beds of coal, varying from 4 to 16 feet in thickness, and diverse in quality. The next year, 1903, a small organized force, under technical direction, was sent into camp on the plateau which now forms the townsite of Bankhead, and the season was spent in further examination, and in opening two or three of the best seams, all of which dip westerly at an angle of about forty-five degrees into the mass of Cascade Mountain.

It was found that the lower coal beds were similar to the one at Anthracite, Alberta, the coal being semi-anthracite in nature, and having the approximate composition of eighty-four per cent. to eighty-six per cent. of fixed carbon, eight per cent. to ten per cent of volatile matter and about six per cent. of ash; these lower beds lie between hard sandstones of Cretaceous age, they average eight feet in thickness, and ignite more freely than Pennsylvania anthracite. They resemble the coal from Anthracite, in being more friable than the American hard coal.

The upper beds were semi-bituminous, having an average composition of seventy-five per cent. to eighty per cent. of fixed carbon, fourteen per cent. of volatile matter and ten per cent. to eleven per cent. of ash. These lie usually between shale roofs and sandstone floors, and vary in width; they have not been developed to the same extent as the lower beds, and no shipments from them have yet been made. The sales of anthracite coal now run from 200 to 250 tons per day.

During 1903 the two lower seams, numbered respectively No. 1 and No. 2, were opened by gangways for a distance of about 2,000 feet. A small tipple and sorting shed, or breaker, was erected, from which coal could be transferred by wagons to the spur from the main line.

In March of this year works of a permanent character were decided upon and begun, and, under the energetic management of Mr. W. H. Aldridge and Mr. W. S. Ayres, the mining and mechanical engineer in charge, are now well advanced, but will not be completed until late in 1905.

Owing to the dip of the beds into the mass of the mountain, and to the fact that its southerly flanks are covered with large deposits of gravel (Cascade Mountain lies at the junction of the Cascade River with the Bow River), and, also, owing to the fact that the outcrops of these coal seams lie at an elevation of several hundred feet above the bottom lands of the valley, it was deemed best to reach these coal beds through a long tunnel driven through the gravels into the mountain, in order that the coal might be delivered directly to a spur of the railway, the grade of which should not exceed one per cent.

This main entry tunnel, 22 feet by 9 feet, starts a little below, and to the west of, a bench or plateau which has been selected for the site of the town of Bankhead, which now has a population of about 500, and, by the spring of 1905, will have 1,500.

The lower, or entry, bench affords ample space for side tracks, storage, machine shops, and all the plant incidental to a coal mine. Both have good drainage, are supplied with fresh water for domestic and fire purposes (by gravity) from the Cascade River, and are lighted by electricity. The plant, which is partially installed, will have its power supplied by four 150 H.P. boilers. Haulage from the rooms and on the surface will be effected by compressed air locomotives, and there is also a separate compressor for supplying air to the coal-cutting machines.

A permanent coal breaker with a capacity of 3,000 tons per diem is now being erected.

On the upper bench a model town is rapidly assuming considerable dimensions; between fifty and sixty dwelling-houses, each of different design, and painted in different colors, an office building and a "mess" house are finished, while other dwellings and two large boarding houses are now nearly completed. The townsite has an ideal location, having the mass of Cascade Mountain to the west, and the magnificent panorama of the Bow Valley to the southeast, while Mts. Rundle, Inglismaldie and other high peaks of the Rocky Mountain Park are on every side.

Much attention has been given, in the opening up and equipment of the mines, to the matter of making them as safe as possible from explosions and fires. The free circulation of air is provided for by upper levels, the main gangways are protected by 60 ft. chain pillars, and the counter by 40 ft. What is known as the "Panel" system has been adopted, i.e. rooms with 60 ft. centres are driven, the start from the gangway being 12 ft. wide, but increasing to 24 ft. and leaving pillars of 36 ft. for support; these pillars are drawn as soon as the room coal is won out of any particular section.

No attempt has been made to estimate the available tonnage in any of the seams, but the width and extent of the outcrops assure the supply for very many years. From the point at which the level of the main entry will cut the chief seams of the measures, the average length on the rise will be about 2,000 feet, thus assuring the company of coal for many years before sinking need be considered. The market for the anthracite coal is very large, and will grow steadily and rapidly with the settlement of the grain lands to the eastward. The major share of the domestic trade as far east as Winnipeg is assured, now that the mines at Anthracite have been exhausted. There is also a large market to the westward, throughout the towns in B. C. and along the Pacific Coast. At present the coal at Bankhead is the only anthracite field of any moment in the Dominion. The chief competitors will be the lignite coal from the Galt collieries at Lethbridge, which is an excellent domestic coal but which lacks the heat units and the lasting qualities of the Banff product; and Pennsylvania anthracite, which is brought into Fort William during the summer months in large quantities, and distributed in the late fall.

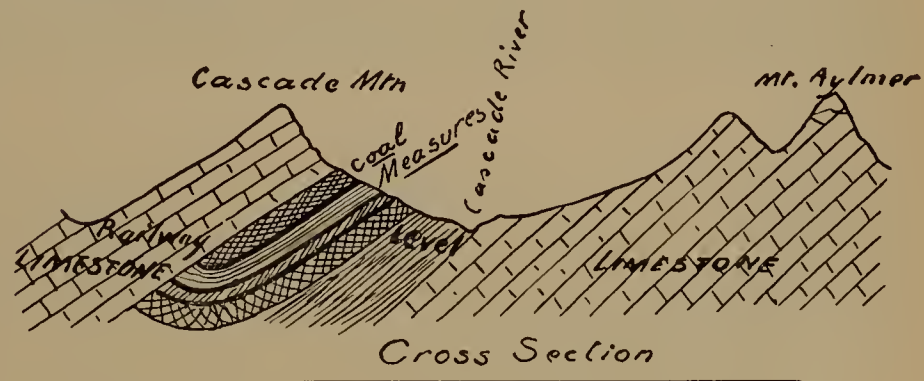
The REVIEW is indebted to the courtesy of Mr. W. H. Aldridge for the photographs from which our illustrations have been made.

Geological Sketch of the Bankhead Coal Field.

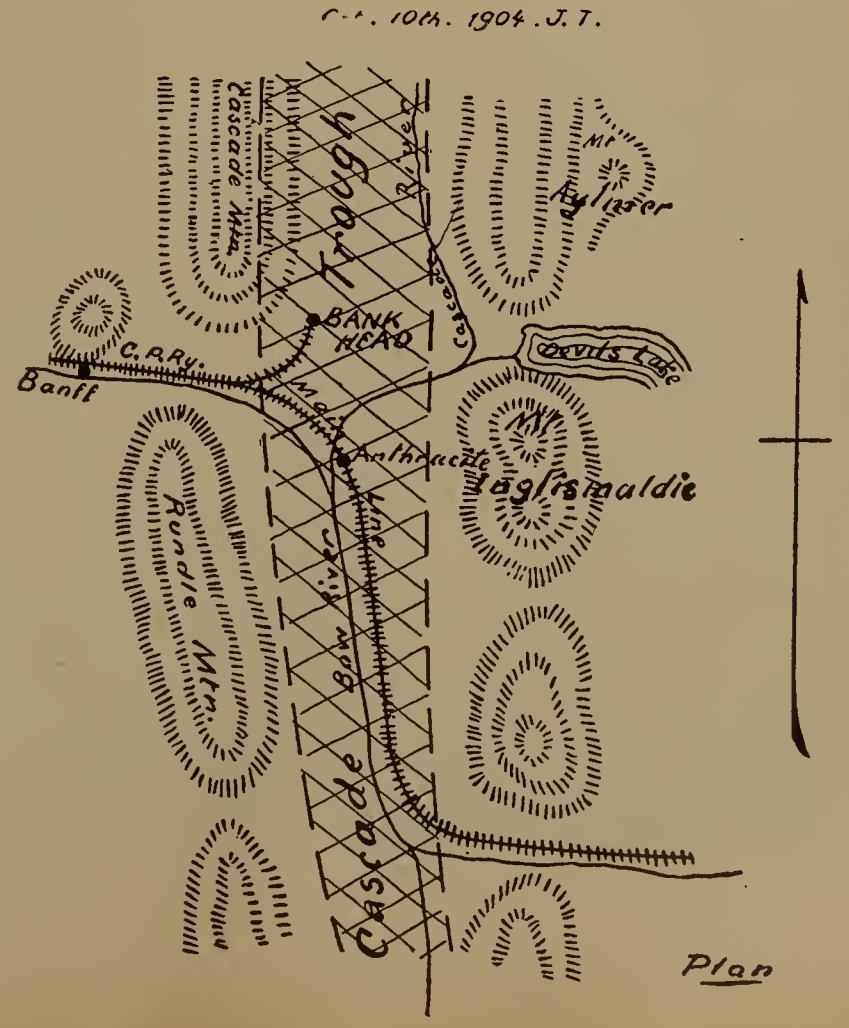
Contributed by J. M. TURNBULL, B.A.Sc.

The coal measures of the Canadian Rocky Mountains are, geologically, chiefly of cretaceous age, and, therefore, of much later origin than the coals of the carboniferous age in Pennsylvania and England.

Rocks of carboniferous age occur in these mountains, and occupy large areas; but they are chiefly composed of limestone and are not yet known to contain coal. The Rocky Mountain range in Canada is composed, in a general way, of a large number of ridges or subsidiary ranges, more or less parallel to one another, and having a general north-westerly direction. Besides the north and south trending valleys thus formed, there are a number of transverse valleys cut out by rivers which, rising in the centre of the range, flow to the eastward or westward. These break the continuity of the subsidiary ranges and form natural passes for roads and railways to cross the main range.



Cross Section



Within certain areas the coal measures occur as elongated basins or troughs, or modifications thereof, occupying the valleys between the above mentioned ridges, and the coal seams outcrop along the lower slopes of the ridges and parallel to them. The edges of the troughs have usually but not always a steep dip, so that it is often possible to tunnel on the seams from the lowest part of the outcrop, that is from the transverse valleys.

One of the most interesting of these occurrences is known as the Cascade trough, which has a length of fifty or more miles, and varies from one to three miles in width. This trough is flanked on the west by a high ridge formed of limestone of carboniferous age, the top of which averages nearly 10,000 feet above sea level, while the valley of the trough has an average elevation of some 4,500 feet.

Opposite Banff the Bow River comes from the west, and, flowing in a large transverse valley, cuts a gap through the ridge; then, turning towards the south, flows along the Cascade trough for ten miles when it breaks through a second gap to the east. The Cascade River, flowing southerly along the northern part of the trough, joins the Bow about the first gap. The main line of the C. P. Ry. follows along the Bow River. South of the first mentioned gap the westerly ridge is known as Rundle Mountain, and north of it as Cascade Mountain.

Where flanked by Rundle Mountain, the coal measures have been worn away to the valley level, leaving no coal above the level which can be mined by tunnelling; so that the mines at Canmore and Anthracite in this section, have been opened by sinking shafts.

Where flanked by Cascade Mountain the case is different; here the outcrops of coal rise from the valley of the Bow and run along the slope of the mountain at an average elevation of about 1,500 feet above the valley and for a distance of several miles. Some seventeen small creeks, running easterly down the slopes, have afforded a number of cross sections of the coal seams, and give an opportunity for the geologist to observe variations due to folding or other causes.

The town site of Bankhead is situated at the south end of the mountain and is connected with the main line of the railway by a spur of easy grade, about two miles long.

The different cross sections vary considerably, due to local folding, etc., as many as twenty-five seams having been found in a single section, though not all of workable size. It is practically certain, however, that six or more of the seams will prove to be workable. The general dip of the strata is about forty-five degrees to the west, or into Cascade Mountain.

The geological section would be about as follows :—

Carboniferous limestone			Cascade Mountain.
Dark ribbony slates		300 feet	
Main Sandstone		300 " to	500 feet.
Coal measures..	shales, coal and sandstones, varying in thickness	2,000 " to	3,000 "
Lower Sandstone		——	——
Non coal-bearing measures	sandstones, slate, etc.	——	——

The two lower seams now being exploited occur about two hundred feet above the lower sandstone and are semi-anthracite in character, burning with a blue flame, and constituting an excellent domestic fuel; they average about eight feet in thickness.

Near the top of the coal measures and running parallel to the semi-anthracite seams occurs a seam of coal, classed as semi-bituminous, which burns with a yellow flame and cokes to some extent in an open fire. This is an excellent steam coal of high efficiency, running from seventy-five per cent. to eighty per cent. fixed carbon, and fourteen volatile matter, with probably ten per cent. ash. It has not been opened up sufficiently as yet to permit of shipments being made.

This co-existence of bituminous above anthracite coal, in the same measures and so close together, is as unusual as it is interesting, and may, perhaps, be partly explained by the fact that the anthracite coals occur between heavy reefs of sandstones while the bituminous coals occur in the softer shales.

To attack the coal commercially, it has been found necessary to tunnel, for a distance of 1,500 feet, through the large deposits of river gravel, which occur along the southern end of the mountain. This tunnel gives an entry to the coal at a point which is accessible by a railway spur of easy grade, and where excellent facilities for yards and side tracks can be obtained. This large entry will allow of any seam in the measures being reached by crosscuts, while all the necessary machinery can be located near its mouth. One large plant will thus take the place of two or more smaller ones, with a resultant gain in economy.

The two anthracite seams, known respectively as No. 1 and No. 2, have also had tunnels driven on them above the gravel deposit for a distance of 2,000 feet.

In working these seams they will be laid out in panels of about 1,000 feet long, each panel reaching from the main entry to the surface. Each panel will be worked separately and can be abandoned and allowed to cave in without affecting the remainder of the mine. Accidental explosions, etc., will thus be restricted to a limited area. The bituminous coal seams have not been sufficiently exploited to determine the best method of working.

A compressed air haulage plant, with locomotives capable of handling seventy-five tons or more per trip, will ensure safe and rapid handling of the output which is expected to reach 2,000 tons per day.

The first prospecting work done in this field by the C.P.R., was begun in the autumn of 1902, and organized development work was undertaken by them one year later.

A bench above the main tunnel has been chosen as a townsite. It is small, but excellently situated and the houses now being erected on it have been laid out with such variations in design and color as to give a most artistic and pleasing effect to the whole, exhibiting at the same time nothing extravagant nor in bad taste. In appearance the town will be worthy of its beautiful surroundings.

CASCADE VALLEY AND PORTION OF TOWN OF BANKHEAD, ALBERTA.

UPPER PORTION OF THE TOWN OF BANKHEAD, ALBERTA.

STREET IN BANKHEAD, SHOWING CASCADE MOUNTAIN.

LOWER PORTION OF THE TOWN OF BANKHEAD, ALBERTA.

TIPPLE AND ENTRANCE TO MINE, BANKHEAD, ALBERTA.

ENTRANCE OF MAIN TUNNEL, BANKHEAD, ALBERTA.

Street in Bankhead, Alberta.

Cars going to the Tipple, Bankhead Collieries, Alberta

Report of the Commission on Electric Smelting.

The Commission appointed by the Dominion Government in December last to investigate and report upon the different electro-thermic processes employed in the smelting of iron ores and the making of steel which were then in operation in Europe, issued its report on the first day of November. The volume is a large one of 223 pages, containing 24 plates and 29 figures on folded inserts. The printing, plates and general get up are of a superior order and reflect credit on the publishers who are, we believe, Mortimer & Co., of Ottawa.

The Commission was issued to Eugene Haanel, Ph. D., Superintendent of Mines, and was specific as to (1) The determination of the cost of one ton of product; (2) the quality of such product, and (3) the cost of the machinery employed. The object of the whole inquiry was to form a judgment as to the feasibility of the successful introduction into Canada of electro-thermic processes for the commercial production of iron and steel. Associated with Dr. Haanel on this Commission were :—Mr. C. E. Brown, of the Canadian General Electric Co., as electrical engineer; Mr. F. W. Harbord, of the Royal Engineering College, England, as metallurgist; Mr. Erik Nystrom, of the Superintendent of Mines' Office, Ottawa, as draughtsman and photographer, and Mr. Thomas Cote, Montreal, as secretary.

The Commission began its active work on February 7th of this year, when it visited the Gysinge Steel Works at Gysinge, Sweden. At these works the Kjellin process is in use for melting purposes only, the mixture used being charcoal pig iron, bar scrap and silcon pig iron. Strictly speaking, the process is not a *smelting* one, but a method of *melting* metals. The product is high class tool steel.

Three experimental charges were run in this furnace by Mr. Harbord, and owing to the fact that the furnace is never emptied the exact weights of the product in relation to the weights charged could not be determined. There also appears to have been, in some cases, a deficiency of electric power, and in consequence a deficiency in heat. There was no doubt in the mind of Mr. Harbord that the quality of the steel produced was of the highest grade.

The second plant seen was at Kortfors, Sweden, which was visited on the 10th and 11th of February, 1904. This plant, having some 800 tons of electrically made steel on hand, and unsold, was not in operation, but was started up out of courtesy to the Commission. The corporation operating is known as the Heroult Electric Steel Company and here, as at Gysinge, the charge is entirely of metals—miscellaneous steel scrap being used—this also is a melting process. As this same process is in daily use at La Praz, under the supervision of the patentee, the Commission reserved its investigations until the La Praz plant was reached.

The furnace at La Praz, France, is practically identical with that at Kortfors, being slightly smaller, and the electrodes being used without water-jackets. Here was found the first introduction of ore into the charge, between eight per cent and nine per cent of the total weight being a pure iron ore. In a subsequent charge the percentage of ore was reduced to between six per cent. and seven per cent. when a high carbon steel was contemplated.

Special care seemed to be taken at these works to remove the first slag and to form a second slag (of lime, sand and fluor spar) and to leave this slag for some time in contact with the molten metal, when, in its turn, it was carefully removed and a third slag of similar composition was again put on; the object of these slags, was stated to be the removal of the last trace of impurity. Recarburization of the metal charged was effected by adding "Carburite," a mixture of pure iron and carbon until the metal showed the percentage of carbon required.

The most important works visited were those of Messrs. Keller, Leleux & Cie, situated at Livet, France, where the Commission began its work on the 28th of March. These works are not manufacturing steel commercially, nor has the furnace used been designed specially for steel, but rather for general experimental work, not only on iron but also on copper, nickel and other metals.

The Commission only saw one charge of steel made from scrap, but witnessed the reduction of iron ore into the different classes of grey, white, and mottled pig iron.

Two or more furnaces, equipped with vertical electrodes, are connected with a central well, if necessary four hearths or furnaces can be so connected, and the resulting metal tapped into pig-beds, or into a ladle. All the materials charged, ore, flux and coke, were broken to pass an inch and a half ring, mixed on a floor and then charged into the furnace. The special points to which attention was directed were,(1) The output of pig iron for a given consumption of electric energy, (2) the yield of metal per ton of ore charged, (3) The amount of coke required for reducing purposes, (4) The quality of the pig iron obtained, i.e., whether suitable for steel manufacture by either acid or basic process, or pig iron suitable for foundry purposes.

The quality of the iron obtained from the first run was No. 3 grey and Nos. 4 and 5 white iron, having total carbon of 3.93 per cent., 4.05 per cent. and 4.14 per cent. respectively with silicon running 1.42 per cent., 70 per cent. and 56 per cent. The average of the slag for the three days' run contained 0.80 per cent. of metallic iron.

The weight of iron in the charge was 8,625 kgs., but the weight of the pigs obtained aggregated 9,868 kgs.; taking the average analysis of the pig at

Carbon	4.1 per cent.
Silicon	2.5 "
Manganese	4.3 "

there would be 11 per cent. of impurities; with this correction the ore should have given 9,691 kgs. of pig iron, and, therefore, 171 more kgs. of iron were produced than the charge contained.

The second experimental run lasted 48 hours: 7,000 kgs. of iron in the ore were charged, and 6,692 kgs. of pig metal were produced; making correction for C, Si, and Mn as before, the theoretical pig iron possible was 7,384 kgs., leaving 662 kgs.

unaccounted for (30 kgs. being in the slag). These figures are not, and under the circumstances *could* not be accepted as accurate, and Mr. Harbord considers that it would be necessary to make a run of several weeks continuously, to distribute and minimize the error.

When a few charges were run with charcoal replacing the coke, the results were not satisfactory since the charcoal burnt away on top long before it got to the reduction zone of the furnace.

In the results, 9,868 kgs. of pig required 5.15 E.H.P. years or .475 E.H.P. year per short ton; at $10 per E.H.P. year the cost of electric energy was $4.75 per ton. 6.692 kgs. of pig in the second run consumed 1.66 E.H.P. years, or .226 E.H.P. year per ton of iron; at $10 per year the cost would be $2.26 per ton of iron produced.

(2) The metal accounted for appeared to be about 97 per cent. of that charged. (3) The amount of coke required varied from 685 lbs. per 2,000 lbs. of metal produced in the first run, to 820 lbs. per short ton in the second run. (4) The quality of the pig metal obtained is shown by many analyses in the report; in the first run it was very grey, containing large amounts of both silicon and manganese, and making a suitable acid iron for Bessemer or Siemens process but for the high manganese.

The second experiment, undertaken with the view of making all grades, did not clearly show that variations from acid to basic irons could be made, although some samples show that low silicon iron occurred at times. In the matter of labor required Mr. Harbord's figures give (at $1.50 per day for labor) the average cost in England per ton for labor at $1.00, in United States at $0.42 and with the Livet furnace $0.94; this would make the electric furnace slightly cheaper than the English practice but more than twice as expensive as the American practice.

So, as far as costs go, Mr. Harbord's figures average about as follows :—

	Per ton of 2,000 lbs.
For Electric energy	$ 3.50
" Electrodes	.77
" Coke	2.38
" Fluxes	.40
" Labor	.94
" Ore	2.76
" Repairs, maintenance, etc	1.30
Total	$12.05

Mr. Harbord's comments are instructive, e.g., "With fuel at anything below $7.00 per ton, the electric furnace cannot hold its own." "When allowance is made for a reasonable royalty (on the process) there is little margin on the side of the electric furnace." "In its present stage of development, the electric furnace is not suitable for the manufacture of other than high-class special steels." Among his specific conclusions are the following :—

"At present, structural steel, to compete with Siemens or Bessemer, cannot be economically produced in electric furnaces."

"Pig iron can be produced on a commercial scale at a price to compete with the blast furnace only when *electric energy is very cheap and fuel very dear.*"

"Under ordinary conditions, where blast furnaces are an established industry, electric smelting cannot compete."

The report is full, lucid, admirably illustrated, and a work which will add to the already high reputation of the Commissioner, Dr. Haanel. It is of the type of monograph for which the Canadian Mining Institute and the profession in Canada have been clamoring, and the REVIEW hails its appearance as the forerunner of many such which the Superintendent of Mines will give us if granted health and funds. Similar, but less costly, pamphlets on several of the metals, minerals and processes will be the best investment the Department of the Interior can make.

We hail this report as an earnest of the quality and character of what the suggested Department of Mines would do, if once created, under its distinguished, able and learned head, Dr. Eugene Haanel.

As to the conclusions drawn it seems to the REVIEW to be manifest that, the electric smelting of iron ores need not trouble our iron masters for the present; that its field, under its present development, is solely in the manufacture of high grade steels and of the many ferro-compounds such as ferro-manganese, ferro-silicon, etc., which are used in comparatively small quantities and can stand high prices; that it is, and will be, more profitable to sell electric power for other purposes than the smelting of iron ores; that a possible field may be the utilization of iron ores which carry such large amounts of the titanium group of elements as to require a greater heat than is usually permissible or obtainable in a blast furnace, and that the electric furnace may find a quicker field for usefulness in the smelting of ores of the more costly metals, such as copper and nickel, than it will with ores of iron.

Negative results are fully as valuable as positive ones, from the investigators' standpoint, and, as we remarked before, this volume contains *unquestionable* results.

The Mining Society of Nova Scotia.

The semi-annual meeting of the Mining Society of Nova Scotia was held at the City Hall in Halifax on Wednesday, the 9th of November. Between twenty and thirty members were present, and several papers of importance were presented. The Society had for a guest the distinguished Dominion Superintendent of Mines, Dr. Eugene Haanel, who exhibited specimens of pig iron and of steel, which had been made in Europe by various electro-thermic processes, and who addressed the Society in the evening on the work of the Canadian Commission which had been appointed to investigate the subject of the electric smelting of iron ores.

The technical paper of the session was that by W. L. Libbey on "The Cost of a Plant for Shaft-sinking and Level-

driving at the deepest level yet reached in the Gold Mines of Nova Scotia."

Mr. Libbey began by noting the impossibility of any figures given being taken as an absolute guide for any other mine in a different locality, but was confident that his figures would be found correct for narrow fissure veins contained in quartzite of the character which is known in Nova Scotia as "whin" rock (a hard, indurated quartzite). He alluded to the increase of costs necessitated by small fissure veins over costs for veins of the intercalated or contact type, known as "main leads."

He then gave the figures below as showing the installation cost of the plant which he had erected at North Brookfield, and which was in use for a depth of 2,000 feet, and capable of going deeper.

Labor, at foundations	$ 778.00
Supplies, for foundations	1,267.95
Lumber	401.12
Carpenters' labor	350.00
Masons' labor	220.00
Boilers and fittings	2,517.00
Air compressor	3,000.00
Air receivers	264.00
Freight and haulage	181.69
Air pipe line and labor	998.33
Accessories	90.20
Hoisting engine	950.00
Wire rope	213.15
Skip	125.00
3 Slugger drills	650.00
Air hose, pumps, and duty	864.40
Sundries	155.35
Total	$13,076.19

The fuel used was run-of-mine coal, costing $5.00 per ton delivered.

Mr. D. W. Robb, the well-known mechanical engineer, read a paper on "Captains of Industry," which was a clever presentation of the lack of technical education in Nova Scotia, and a plea for its development.

As reading for a father of growing sons the paper is most valuable, and the REVIEW hopes to find space in which to print it in full.

The meeting adjourned after voting thanks to Dr. Haanel for his courtesy and lecture.

The Princess Royal Mines.

Our esteemed and vivacious London contemporary, *The Rialto*, in one of its recent issues devotes a page to the attempted flotation on the other side of the Princess Royal Mines, situated on the coast of Northern British Columbia, and, incidentally pays attention to a Mr. A. R. Harvey, of Liverpool, and the Hon. Wm. Pugsley, of St. John, N.B. We excerpt some interesting extracts :—

"Mr. A. R. Harvey, a Liverpool financier of incorrigible energy, is just now busy endeavouring to float a company to acquire and work the Princess Royal group of mineral areas in Northern British Columbia, and he purposes forming a company to be called the Princess Royal Gold Mines, with a capital of £500,000. Mr. Harvey will be known in connection with the ill-fated Commercial Development Company, Bischoff's White Lead, and other ventures that have not earned a European reputation as dividend-payers. But "nothing venture nothing win" is evidently Mr. Harvey's motto, and he now proposes, as before stated, to attack British Columbia. The name of British Columbia leaves a very nasty taste in the mouths of investors on this side of the Atlantic, seeing that we have had so many mining fizzles sent over from that country. Judging by the papers in our possession, we gather that the Princess Royal venture is being promoted by an enterprising group of New Brunswick speculators, headed by Mr. Pugsley, the Attorney-General of New Brunswick. This gentleman is, unless we are mistaken, a friend of the celebrated Mr. J. Carling Kelly, of Sapphire Corundum renown, and it may be that Mr. Kelly is interested in the Princess Royal. But, notwithstanding that so high an official as the Attorney-General of New Brunswick is assisting in the promotion, and has agreed to become a director of the company, there seems to be a lack of funds for paying the necessary registration and promotion expenses, and Mr. Harvey has consequently hit upon a scheme for "raising the wind," which he hopes may successfully work the oracle. Here is Mr. Harvey's scheme :—

[Memo.]

£5,000 is required to pay the stamp duty, solicitors' expenses, printing and advertising, and the general preliminary expenses in bringing out the Princess Royal Gold Mines, Limited.

The property has been reported on by Mr. Philip Gilman, A.R.S.M., Vancouver, British Columbia, of the eminent firm of Pellew-Harvey, Bryant and Gilman. It is being worked at the present time, and is showing a profit of over 50 per cent. upon every ton of ore taken out, without proper transport facilities.

A copy of the sworn affidavit of the Hon. William Pugsley, His Majesty Attorney-General for New Brunswick, and smelter returns attached.

It is proposed to bring out a company with a capital of £200,000 in Preference shares and £300,000 in Ordinary shares during October or November, with £60,000 Preference shares underwritten to cover the working capital and the expenses of bringing out the company.

The contractor proposes to raise the aforesaid £5,000 to cover preliminary expenses by issuing an interest in this undertaking to the extent of £5,000 in cash and £10,000 in Ordinary shares, each participator of £1,000 receiving his money back as soon as the company goes to allotment, and a bonus of 2,000 fully-paid shares.

Now, we cannot say that Mr. Harvey's offer is particularly tempting. To suggest that the mines would ever pay on the

inflated capital suggested is an insult to one's common sense; but this is a matter that would not concern Mr. Harvey, or perhaps his New Brunswick friends. We happen to know something about the Princess Royal Mines, and we have no hesitation in saying that they would never pay their working expenses, let alone a dividend, on any capital at all. We say this deliberately, in face of the opinions of the eminent experts who have reported favourably, and also in face of the supreme optimism of the Attorney-General and his friends, whose only idea is to make a profit by promoting the company."

The REVIEW is in no position to controvert the soundness of the statement that £500,000 is altogether too large a capitalization, but it is in a position to affirm the high grade character of the ore, and to confirm the average value of the ore which has been shipped at $80.00 per ton. There is, however, no assurance as yet that this character of ore will continue indefinitely, and we should prefer to attack the scheme (if we attacked it at all) on the ground that the property is yet in the "prospect" stage, and the proposed capital entirely unjustified.

A New Mineral District in Quebec.

Sir :—

Having been out in the field for the most part of the season, it may be interesting for the readers of the REVIEW to know some results of a two months' exploration of the region to the south-west of Lake Mistassini, and to learn that a new mining district has been discovered which, so far, appears to be very promising.

This district lies near Lake Chebogamoo, which is about 200 miles north-west of Lake St. John. It covers an area of about 20 by 40 miles, in which the geological formation is the Huronian (as determined by the Canadian Geological Survey) and which is comparable with that of our Eastern Townships. I went to explore this region on account of discoveries of asbestos and copper ore which were made there last year by Mr. P. McKenzie, of Montreal, and I have ascertained that there exists in the district a large belt of serpentine rock, which, at one point specially prospected, shows a quantity of good asbestos with fibre varying from one inch to three inches in length.

There are also veins of copper ore (chal-copyrite carrying bornite), iron pyrite and magnetic iron oxide; the latter is probably abundant, if one may judge from the strength with which the needle is attracted in certain parts of this new region.

I also discovered gold, which was easily visible to the eye in one quartz vein, which measured over 30 feet in width and which I traced for 2,000 feet. In the vicinity of this vein, but at a considerable distance from it, I found colors of gold, which leads me to suppose that there may be a section which will be gold bearing.

I regard the region as a very important one, from a mining standpoint, and one which can be quickly developed when traversed by a railway. The construction of such would be an easy matter as grades are good; the altitude is only 1,200 feet above sea level.

I have also recently visited a region in the valley of the St. Lawrence where, many years ago, the occurrence of natural gas was noted.

The people of the villages of Ste. Genevieve, Yamachiche, and St. Barnabé are now using this gas for domestic uses, and a company is boring in the vicinity of St. Gregoire with the expectation of finding gas in larger quantities.

Yours truly,

J. OBALSKI.

Quebec, Nov. 18th.

The Mines of Ontario.

By W. E. H. CARTER, B.A.Sc.*

(Continued.)

"As a usual thing the so-called Laurentian rocks, consisting chiefly of granite, granite gneiss and syenite gneiss, form rounded areas half a mile to a number of miles in width; and enclosing them are great meshes of Keewatin (Huronian) schists and eruptives, generally green in color and basic in character, but sometimes pale and silicious. Lawson has proved that the granitoid rocks push up as eruptive masses through the schists, nipping in the latter as synclinal folds with bedding having a steep dip away from the Laurentian. The Huronian rocks are chiefly eruptive flows and metamorphosed volcanic ashes, but sometimes water-worn conglomerates. At the junction of Laurentian and Huronian there is generally a strip of greatly disturbed territory where the granite or gneiss has floated off small or large blocks of the green rocks, or has pushed dikes of granite or felsite into fissures of the Huronian. Eruptive bosses of a later granite in many places penetrate both Laurentian and Huronian, and likewise send dikes into the adjoining rock.

". . . . .It is evident from the sketch just given that the region was one of great disturbance during Archean times, mountain building, earthquakes and volcanic eruptions having been active, not alone in causing the general geological relationships which we now find, but also in opening up innumerable fissures to be filled with quartz and other minerals by circulating heated waters, thus forming the present ore deposits.

"At a much later age the region, mountainous at the close of the Archean, was worn down to an approximate plain, disclosing on an ice-smoothed surface the complicated arrangement of rocks and veins now so interesting to the geologist and prospector.

"A more complete description of the geology may be found in the reports of the Geological Survey of Canada, and in previous reports of the Bureau of Mines." (5)

On account of the generally flat nature of the country the gold mines, and, in fact, practically all the deep mines with one or two unimportant exceptions, have to be opened up by shaft, instead of by tunnel, as in more mountainous districts. This makes development of the ore bodies somewhat more expensive, especially during the initial prospecting stage, than in such countries as British Columbia.

Out of the great number of auriferous veins or reefs which have undergone exploration in this western Ontario field a few have attained importance by the extent of the mining done thereon and by the gold produced, the percentage of suc-

*Paper read at the Sixth Annual Meeting of the Canadian Mining Institute.

(5) Lake of the Woods, A. C. Lawson; Geol. Sur. Can., 1885, Part CC; Rainy Lake Region, 1887, Part F; Bur. Mines, Vol. IV., p. 45, etc., and Vol. VI., pp. 71-124.

cesses being probably as great as in any other gold area in Canada. But certain serious difficulties peculiar to this part, and more or less to all of Ontario except the few big mining camps, have obtained from the start, and still exist to an important degree, which re-act to the detriment of the area. Chief of these is the almost universal disregard by the operators of the first principle of any business undertaking which is to place in charge of the work from the start a man of the necessary experience and ability. A mining enterprise need have but little more uncertainty about it than any other industry, if entered into with a full knowledge and appreciation of the risks, and with a technically qualified engineer in charge who can properly valuate these risks and govern operations accordingly. This constitutes the key to most successful mining ventures. The "practical" miner, perfectly fitted to hold the position of foreman, has not the scientific training necessary for a correct interpretation of the circumstantial evidence on the value of an ore body arising during development. What is the cause of this negligence of the common-sense way to mine ? It is that the mining companies found there do not realize the necessity for such men. Usually these corporations are composed of many shareholders ignorant of everything connected with mining, and therefore led to believe that because other mines in the neighborhood are run by practical miners so can theirs be, particularly since such practical miners may be had at a much cheaper wage than the higher-priced engineer. They do not realize that the latter may save his salary many times over by his superior knowledge and ability.

The specimen character of the auriferous deposits no doubt accounts for the ease with which these small companies are floated amongst this class of investor. Veins which may be unimportant in size and average value produce occasionally remarkably enticing free gold samples and high (but unrepresentative) assay values, on the strength of which the properties may readily be disposed of. Following the history of such concerns to the end, we find that one class, after doing considerable mining and exposing some vein or rock, has spent all the working capital, with nothing to show for it, because of not having adopted from the start a comprehensive plan of development; and the other, having a little more cash, goes further and erects a mill, to appease the unceasing cry of the shareholders for dividends, after which its funds also are exhausted, and with no ore in sight, ready for stoping from the undeveloped vein, the mill stands idle. The close down of the mine is in each case certain, if not for good, for an indefinite period,—for as the investing public generally look at it—who is going to put more money in a property on which so much has already been spent with nothing to show for it ?

This state of affairs accounts in large part for the apparent failure of this gold area to become generally productive. The extreme case of misdirected energies occurs where mining has been done in country rock in which absolutely no *ore body* can be seen or is indicated. Such instances are by no means rare. The most prevalent mistake, however, consists in devoting time and money to veins which are too small or narrow to warrant the expectation of ever making a paying mine of them, although they are possibly quite rich in gold. There is no excuse for taking up such properties, except it be that the operator would not employ someone who could and would properly valuate them for him, that he might be induced to try a better showing elsewhere.

Plenty of other deposits may, on the other hand, be found which at least have the necessary qualifications of size, and of these quite a number, which gave reasonable promise of success on the surface, have developed into productive mines. Just at present, however, a wave of abnormal activity has struck many of them, due in most cases to causes quite outside the merchantable character of the ore.

Observations made during the past several years, while in close touch with the industry, have led to the above conclusion and to the belief that the area as a gold producer is not as hopeless as it appears. Let the energy and capital of the gold mining investor be directed with caution, common sense and patience to where just chance of success exists, and then at least will satisfactory proof, one way or the other, as to the value of these auriferous deposits, be given.

Proof of the seriousness of the situation for this western gold area, should inexperienced management continue, is furnished by the fact that out of a total of 50 gold milling plants (all stamp mills but three), with the total equivalent of 558 gravity stamps, which are being or have been erected there since the start, only seven mills ran at all during the past year or so, and of them but 3, with their total of 33 stamps, attempted steady operation on what the mines produced. These plants range in size from the 1 or 2 stamp test-mill to the 40-stamp battery.

The corresponding figures for the whole Province are also worth noting, since much the same conditions exist throughout. As nearly as can now be discovered there are or were in all 74 gold mills, of which 5 were Crawfords, a few the Tremaine steam stamp, one a Krupp ball, and the rest the ordinary gravity stamp mill, having a total equivalent of about 787 gravity stamps. During the past year or so only 12 of these mills, with a total of 146 stamps, operated at all, and of them but 8, with 113 stamps, attempted continuous production, and generally only for intermittent and limited periods.

It would be unfair to let the above statement go unqualified by the greater and more normal activity of the years just previous, when the old standbys, such as the Sultana, Mikado, Deloro and others, were in full swing. During the past two years or so 22 of these mills were in operation, some continously and the rest intermittently, with a total of 362 stamps dropping. To various financial or managerial difficulties, as well as to the state of the ore bodies, may be ascribed the present close-down of these important mines, which causes may disappear and operations be resumed at any time.

In the western Ontario area amongst the important mines may be included the Sultana, the Mikado, the Regina or Black Eagle, the Golden Star, Sakoose, Big Master and Huronian. It is not possible to give here the total output in gold of all these mines, interesting as it would be, but as an indication of the same, the amount of development may be summarized. The Sultana mine has reached a depth of between 600 and 700 feet, with lateral workings over a quarter of a mile in length, one of the stopes (the main) having a minimum cross-section of about 25 feet by 25 feet and a maximum of about 60 feet by 120 feet and extending from the first down to the seventh level, where a fault cuts it off. A 30-stamp mill, with a chlorination plant for the concentrates, has treated this ore for a number of years past, during which operations were fairly continuous. Recently the use of the Frue vanners was discontinued, and on the plates alone an extraction of 83 per cent. of the value was made. The gold bullion here has averaged a fineness of 840, typical of the gold in these non-argentiferous ore bodies of western Ontario. Mr. J. F. Caldwell, who has been closely connected with the mine since the start, states that the total production of the mine has amounted to about

$500,000, and that the average value of the ore was about $8.00 per ton. An energetic effort is now being made to locate the faulted portion of the ore body.

The workings of the Mikado are even more extensive, having attained a depth of between 1,300 and 1,400 feet along the vein on the incline. The ore shoot continues down in the lower levels, but there the vein passes entirely out of the granite country, which in the upper levels it either cut through or was in contact with, and enters the trap. A drop in values accompanied the change, so that latterly ore running $5.00 or less per ton was the best obtainable. Whether a change for the better exists at still greater depths, where the vein and granite may again come in contact and values increase, remains now for others to find out, the present company having decided to cease work. The last year's operation of this mine furnishes some interesting figures of what can be done in this direction with an averagely well equipped gold property. During 1901, for a period of eight months, the ore milled averaged in value $3.14 per ton, the total extraction by amalgamation, followed by cyanidation of the tailings, amounting to 87 per cent. For the next three months the ore ran $5.07 per ton, and extraction increased to 91 per cent. This latter figure (91 per cent.) is made up of an extraction of about 65 per cent. by amalgamation and 20 per cent. by cyanidation of the tailings. About the same proportion was obtained on ore of different values. To quote from the manager's report: "Of course, it was quite impossible to meet all expenses during the first period under comparison, but our total costs, including development, maintenance and fuel have been fully covered during the last four months and, indeed, a clear profit of about $600 has been made in the month of December; thus showing that with a small plant (30 stamps) and a narrow vein in a small ore shoot, it is possible to make a fair profit on ore that averages $5.00 to the ton." The Mikado mine has produced something over $500,000 in gold.

In the Black Eagle mine the bottom levels, at about 550 feet depth, disclose a vein from 6 feet to 8 feet wide. This vein fills a true fissure and extends without interruption throughout the extensive workings, but at a somewhat less average width than this. The pay ore lies in separated shoots. A new 30-stamp mill recently erected replaced the original 7 Tremaine steam stamp batteries, which, both here and elsewhere in the area, have proved unsuitable to fine crushing, besides prohibiting inside amalgamation. This mine, originally called the Regina, was found in 1894, and in 1895 a 10-stamp mill was erected and operated. Later this milling plant was replaced by the above-mentioned 7 Tremaine batteries of 2 stamps each; but as they could not be operated successfully the present new equivalent 30 gravity stamp mill was put up in 1902. Since the beginning the ore milled has returned a little over $200,000 in gold. The ore is low grade, averaging probably between $4.00 and $5.00 per ton.

The Golden Star mine, near Mine Centre, has had rather a checkered career since 1898, the year of its first operation, and finally has been closed indefinitely. The trouble does not, I believe, lie so much with the condition of the ore in the vein as with the methods of development. The ore was "gutted," and after that, although the pay shoots in the bottom levels are reported to show ore well worth following, no more money could be raised to again undertake the necessary unremunerative work of opening the vein to greater depth and blocking out more ore. Mr. H. H. Wood, late manager of the mine, has kindly given me the following interesting statistics of that mine's operations, to supplement accounts already published (6). The shaft reached a depth of 530 feet along the vein on its incline of 80 degrees and is timbered with a skiproad. The drifting on the seven levels aggregates 1,894 feet, the shortest drift measuring 58 feet, and the longest, the sixth, 567 feet. The stopes exhibited a maximum width of 14 feet of ore, at which points the richest portions occurred, and a safe average of 3½ feet, and from them and the drifts there were raised and milled 19,823 tons of ore, which produced bullion valued at $160,876.35. The value saved per ton was $8.11, and that lost in the tailings $2.50, which makes the total average value of the ore amount to $10.61 per ton. An appreciable tonnage of lean ore from the last development work is included in the above total tonnage milled, which lowers the average value somewhat more than need be. The ore was crushed in a 10-stamp mill and concentrated on Frue vanners, but no attempt was made to save the values in the tailings. The ore was free milling to a varying degree, according to the part of the mine the quartz came from, the per cent. extraction by amalgamation ranging from 65 to 80. During the last operations mining and milling together were done for $3.44 per ton; but now that living, labor and transportation costs are cheaper, with the advent of a railway, the Canadian Northern, this figure should be considerably reduced.

The Sakoose mine, near Dyment, produced a good deal of gold bullion, but the attempt to carry the ore some 130 miles by rail to the stamp mill at Keewatin was found (since the ore was not unusually rich) to be unprofitable. The ore body stands ready for a more economic mode of development and treatment.

The development of the Big Master mine in the Manitou area gives interesting data on the character of similar veins traversing the green hornblendic and chloritic schists common to the country. The pay ore lies in certain well defined shoots, and when more than one occurs in the same vein they are all, as a rule, parallel in their dip. There may be one or two more or less extensive shoots or again a number of short ones separated by similarly short stretches of barren vein, as is the case I believe at the AL282 or Sunbeam mine, near Island Falls, Seine River. Also, the values do not extend into the false walls of soft altered schist, but are closely confined to the main quartz body or vein. The 10-stamp mill at this mine has made a number of runs on the ore and produced considerable bullion; but the development of the ore body has never been sufficiently in advance of stoping to furnish a steady or continuous supply.

The gold ores of Ontario are of low grade, averaging probably less than $10.00 per ton. Continuity of the pay shoots both in size and value may be expected to reasonable depths, as shown by the development of the few deep mines above mentioned.

Some of the mining companies in this western area seem to be consumed with the desire to get hold of as much of the earth in the vicinity of their mine as possible, and according as they succeed in this so do they squander the available treasury funds. Better devote the money to developing one paying mine than to feeling rich in the possession of many idle locations. Out of over 50 companies mining on properties of various kinds during the past year or so in this area more than half held on the average between seven and eight times more mining land than necessary, i.e., more than the area of the one or more locations of forty acres or so to which all mining is

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(6) Bur. Mines, Vol. VIII., pp. 45-46, 76-79, 263, et seq.; Vol. IX., pp. 66-68; and Vol. X., pp. 79-80.

confined. Some of them hold twenty times more than the area of that under development. This practice of so loading the company down has, in most cases, no advantages either for the company or for the one mine worked, but, on the other hand, uses up much of the precious working capital which should be devoted to making the one mine a paying proposition.

SILVER MINES.

In the same year in which gold was discovered in the eastern townships, 1866, the first important find of silver was made on Thunder Bay, Lake Superior, at what was afterwards known as the Thunder Bay mine. The discovery of numerous other silver-bearing veins followed in the next few years in the same immediate area, along or near the north shore of the lake, chief of which was the Silver Islet, found two years later, in 1868. This islet was in reality merely a rock of about eighty feet square, rising a few feet above the surface of the water a mile or so from the shore. Not until 1881 did the occurrence of the same precious metal in the Rabbit and Silver Mountain areas, twenty and thirty miles southwest of Port Arthur, also become known.

The formation in which these ores occur consists of the Animikie, the earliest of the Cambrian system. The Animikie and Nipigon rocks combine to cover a considerable area, nearly surrounding Nipigon Lake, and from there south to the shores, peninsulas and islands of Lake Superior in the same vicinity, and southwest to the international boundary line. Nearly all the veins cutting these rocks closely resemble one another in the nature of the gangue which fills them. They are formed either entirely of quartz more or less amethystine and locally open or drusy, or entirely of white crystalline calcite with pockets of amethystine quartz, or of a general mixture of this quartz and calcite. Fragments of the wall rock are also usually included, together with scattered green and purple fluorspar. The more common metallic minerals consist of pyrite, blende, galena and chalcopyrite, while the silver occurs both as the sulphide (argentite) in leaves, masses on crystalline, and in the native state in leaves, grains and threads. Quite common widths for these veins are twenty to thirty feet, though the average is less than this. The tendency also is for the ore to run in narrower bands along one or the other side of the vein, particularly in the wide veins.

The distribution of the silver through the lodes is irregular, with no apparent connection between the different pay shoots. In all the mining so far done no law seems to have been discovered governing these conditions, or the mode of occurrence of the silver, which makes extensive development underground necessary. This, in turn, has caused the close-down sooner or later of all these silver mines not now in operation. The main bonanza at the Silver Islet, for instance, produced about $2,000,000 worth of silver, and it consisted of two parallel pay shoots on adjacent branches of the lode, each measuring about one hundred feet along the hanging wall, about three hundred feet in depth from top to bottom, that is, down to the sixth level, and from six inches to two feet in width. During two different years at the start the silver output at this mine amounted to over $640,000. At other mines similarly rich, but limited, shoots were worked out. After the Silver Islet mine reached a depth of 1,230 feet, from the year 1870 until 1884, when it closed down, local conditions, mainly heavy inflow of water from the overlying lake and heavy charges for maintenance, forbade further development. The other bodies of ore struck in the extensive exploratory work by both mining and diamond drill during the last year or so of operation determined, however, that such veins may reasonably be expected to contain more than the original find or shoot of ore.

The Silver Islet mine produced in all about $3,250,000 in silver, most of which resulted from the smelting of the hand-cobbed ore; but subsequently a 50-stamp mill and concentrating plant was erected on the mainland opposite the island and the leaner ore run through. It was in this mill under the superintendence of Capt. Frue that the present Frue vanner of world-wide fame was invented.

The mines in the Port Arthur area produced silver more or less steadily, by the smelting of shipping ore, or of the concentrates after milling, until about 1892, when the sudden severe drop in the price of this metal caused most of them to close down. Since then the West End mine alone has operated at all extensively, and the success attained there will no doubt sooner or later lead to the re-opening of some of the other old mines. In fact a year or so ago a number of these properties, consisting of the Porcupine, Badger, Keystone and the West and East End Silver Mountain Mines, were consolidated under one ownership, with a view of working several or all on a collective plan, thereby reducing cost and increasing profits from these irregular ore bodies.

The practice at the West End mine, where operations are for the present concentrated, involves hand-sorting underground of shipping ore, that is, ore rich enough in silver to allow of direct shipment to the nearest custom smelters in the United States, and concentrating the remaining lower grade material by fairly coarse (20 mesh) wet crushing in a 20-stamp battery followed directly by hydraulic sizing and concentration on 9 Frue vanners. The mill will treat 80 tons of ore per day, or 4 tons per stamp.

There is under serious consideration the project to erect a smelter somewhere in this Port Arthur district primarily to treat copper ores. If built it will give further inducement to mining for silver, since all these ores could also be smelted there; probably those lean in silver as well as the rich, since the gangue of calcite would serve for fluxing other ores.

The other occurrences of silver in the Province, with the exception of the recently discovered veins in the Temiscaming area, are all in connection with other minerals of equal or greater importance, namely with gold ores, lead ores, and with gold in the copper ores of the Parry Sound district, as at the Wilcox and McGown mines. Of the argentiferous galena veins that of the Victoria mine north of Garden River station, traversing Huronian trap schists simply as a mineralized belt of the same in close proximity to the Laurentian granites, is a prominent example. Large quantities of galena have been shipped from it, and some from the Cascade mine in the same vicinity, the silver content running from a few ounces to 168 ounces per ton.

Earlier than 1890 records exist of the finding and exploration of gold and galena bearing veins carrying silver in the Temagami and Temiscaming country. Two references speak of veins 10 feet or so in width in which the galena contained from 6 to 64 ounces of silver, the lodes traversing trap and slate. None of the ores were mined on a commercial scale, however, possibly because so far away from lines of transportation. With the advent of the new Temiscaming and Northern Ontario Railway prospecting began again with renewed vigor, and amongst other important minerals the argentiferous cobalt-nickel-arsenic ores were found near Haileybury. These are now being mined in a hurried attempt to ship some of the ore to the railroad while the sleighing re-

mains. During the coming season we may expect not only extensive surface prospecting but some systematic mining of the known veins; and interest may become active again in the older fields above referred to. As official descriptions of these new ores have issued in several prominent mining journals and also in pamphlet form from the Bureau of Mines the only reference here will be to their silver content. The best specimens of the western Ontario silver ores do not compare with these new finds, so great is the percentage present in some of the veins. The silver occurs almost entirely in the bright native state interwoven throughout the vein. In one vein 8 inches in width the silver content ranges from about 16 per cent. to 20 per cent. Some drift boulders of 10 to 50 lbs. weight found in the vicinity of the veins carry as high as 70 per cent. silver, the ore in place in the veins from which these masses presumably broke off locally approaching in silver content the same high figure. A carload of such ore as this is about all a man needs "to live happily ever after."

The galena ores of the eastern counties of Peterborough, Hastings, Addington, Frontenac, etc., are for the most part almost free from silver. The eastern end of the Province is not a silver area.

COPPER MINES.

The present most important copper-bearing area comprises that portion of the Province bordering the north shore of Lake Huron from Lake Superior on the west to Wahnapitae Lake on the east, and probably still farther northeasterly, since the same Huronian formation extends on to the Provincial boundary; but at that end it has not been much explored. Copper was known to exist in this region several centuries ago, the Jesuit missionaries being amongst the first to bring specimens and reports of finds back to the land of the white man. Not until 1770, however, was any attempt made to explore for the ore with the idea of mining. That year a party was sent out by English capitalists to the area in the vicinity of Sault Ste. Marie; but no success attended their efforts, doubtless for many reasons not hard to imagine in such a wild, unknown land so distant from home and supplies. Until the middle of the next century we are without record of any further attempts at mining; and then the spell was broken only by the sudden exploitation of the copper areas on the south side of the lake in Michigan. That was in 1843, and it proved sufficient to rouse an interest again in our own areas and in the possibility of finding rich copper ores here also.

Reports of the same at that time were frequent, and after examining many areas along the north shore of Lake Huron the locations now known as the Bruce mines were, in 1846, taken up as the most promising, and active development begun. There was then but one company operating in the field. Other mines, the Wellington and the Huron Copper Bay, were subsequently opened up on the extension of the same lode in a distance of about two miles, all showing the veins to be rich in the copper sulphide, chalcopyrite. Of the success of these mines, in spite of the great difficulties in the way of transportation, much has already been recorded and need not again be gone into here. It appears that the ore as mined contained at the start about five per cent. copper, the chalcopyrite being disseminated through a matrix of quartz. The veins, of which there were several roughly parallel to, as well as off-shoots from, the main bodies, fill true fissures in a dike of diabase traversing the Huronian rocks of the area. A concentrator was erected and all ore raised to a 20 per cent. copper content prior to shipment to both England and the United States for complete reduction. Later, to avoid the heavy charges for transportation, smelting and the lixiviation and cementation processes were tried at the mines, but without much success. The ruins of many of the old stone buildings may still be seen. It has been ascertained that copper concentrates, precipitates, ingots (presumably of blister copper) and slags amounting to about 40,515 tons and realizing about $3,300,000 were shipped from these mines in this period of thirty years, from 1846 to 1875, during which they were worked. No other mine in Ontario, purely a copper proposition, has yet approached the output of this first copper mine.

Practically the same state of affairs exists in the silver district at the west end of Lake Superior, where the Silver Islet mine, one of the first found, produced during its lifetime much more silver than has any other mine to date.

Of course, prospecting and mining covered, necessarily, very limited areas during these early years, and not until latterly is the country receiving the attention it merits either from prospector or capitalist. The lowest workings in the Bruce group are at about 550 feet; but stoping has not been carried quite so deep. It was found in the bottom levels that the copper content had decreased somewhat. In fact, according to the reports of two eminent engineers who examined the mine a few years ago, an average of about 3.5 per cent. is what the ore now shows, which made it impossible to profitably operate at that time when the ore had to be shipped as far as England. Just about the same time also the United States cut off the remaining market in that country by declaring an import duty on the concentrates of five cents per pound copper. This was no doubt the main reason for closing down in 1875. In 1899, on the strength of the above mentioned reports, the mine was taken over by another English company, put in shape for mining, and a concentrator erected of the most approved design to have a daily capacity of between 400 and 500 tons of rock. Provided the mine can show the quantity, it should be possible to now treat such ore profitably.

The Massey Station mine is one of the most promising in the area. The ore body, chalcopyrite in a silicious gangue, occurs in a wide dike of greenstone, probably a diorite, and either in or close to its contact with the quartzite country. It has a width of from six to eight feet. It has been opened out to below the 600-foot level, and throughout will average about four per cent. copper. Some four thousand tons of such ore was raised during the past year from the development work alone. Not until now, however, after first definitely satisfying themselves by this extensive preliminary development that the ore exists in merchantable quantity and of a quality requiring certain means of reduction, has the company given the question of treatment active consideration. This commendatory example of judicious mining might well be followed by other operators in the Province. For a month or so this spring experimental runs have been made on this ore at the Victoria mine smelter, temporarily leased for the purpose, and some blister copper produced. A 50-ton Elmore oil concentrator is now being erected at the mine, more as an experiment on this class of copper ore than with the intention of permanent adoption.

The Rock Lane mine, on the other hand, stands out in the district as a regrettable case of energy misdirected from the start. There, extensive surface plant, including mining machinery, railways and finally a 22-ton concentrator, was installed and built before practically anything was known of the size, value and character of the ore body. The stockholders did all this on their own account without technical advice, considering, in their excited ignorance of such things that the

mere fact of having fine surface showings of ore was reason enough for their way of mining. Fortunately the ore body was large, and although opened out only to the second or 200-foot level, furnished sufficient ore at this one point of underground development to keep the concentrator running a year or more. With the workings gouged clean of ore, large additional working capital now became necessary; but this the stockholders would not put up and the property had to be closed. It is not fair to lay the blame to the ore body of which so little is known, especially when it is understood that the vein can be clearly traced for considerably more than two miles over the surface. The ore stoped from the vein ran in width from ten to twenty-five feet, with an average copper content of about three per cent. It consists of quartz intermixed with more or less trap, the whole impregnated with the chalcopyrite and with some of the secondary copper oxides, and fills a fault fissure in the brecciated trap of this area near the contact with the Huronian quartzites.

There are a number of other promising mines in the area, amongst which may be mentioned the Superior, which has been under active exploratory mining for the last two or more years, as a result of which some remarkably rich chalcopyrite ore has been produced. On Lake Wahnapitae also some copper-bearing veins have recently been opened up.

In the Parry Sound area, surrounding the town of that name, only two mines, the McGown and Wilcox, have produced and marketed any ore, and that only in limited quantities. Development throughout the area is superficial and accomplished without much system or energy. The Wilcox during the latter months of last year re-opened and raised about 2,000 tons of four per cent. chalcopyrite ore. The copper in the area occurs usually as chalcopyrite segregated through mineralized bands of the gneiss country; massive bornite veins up to three feet wide were found on the McGown intersecting these other mineralized bands.

(To be continued.)

The Hall Mining and Smelting Company, Limited.

The fifth annual report of the Hall Mining and Smelting Company, which was presented to the shareholders on the 31st of October, is of interest to a sufficient number of our subscribers to justify its insertion in full, did our space permit. We regret that we are unable to find the space, but we insert in full the chairman's address, and give a summary of the reports of the business manager and of the manager of the smelter.

The fifth ordinary general meeting of the Hall Mining and Smelting Company, Limited (British Columbia), was held on Monday at River Plate House, Finsbury Circus, Lord Ernest Hamilton (the chairman) presiding.

The Secretary (Mr. A. E. Ashley) having read the notice calling the meeting, and the auditors' report having been also read,

The Chairman said the item of interest which will first strike any shareholders who have looked at the accounts for the past year will be the fact that this year we have made a profit, as against a loss made last year. I do not want to dwell particularly on the profit we have made, because it is a very small profit. It is hardly worth talking about, except as an indication, and I think, as an indication it is of considerable value, because since the company has ceased to depend on the Silver King mine as its chief source of revenue, we have rather got into the habit of looking upon the smelting business as being very little more than self-supporting. However, in this past year that smelting business has shown a profit. That is an indication of possibilities to come, and, as such, I think it very interesting. Now, the reasons that have enabled the smelting business this year to show a profit are set forth in the re-report. You will see that there have been two causes; one has been the bounty on lead announced by the Canadian Government, and this bounty gave a very distinct stimulus to the lead-mining industry in British Columbia during the latter half of the period under consideration. During the first six months of the past year this did not take effect, and, therefore, the benefits arising from it were not felt by this company; but during the last six months they were felt to a very appreciable amount. That is one of the causes, and the other is the possession, which we have had during this period of a one-fourth interest in the Emma mine, which has enabled us to supply our smelter with fluxing ore of a very suitable quality, and without experiencing the difficulty we have always had in former years of obtaining a constant supply of good fluxing ore, because, unless the supply of fluxing ore is constant, it is of no value at all. You must have a supply that you can absolutely depend upon, and that we have got in the Emma mine. I will refer later to the Emma mine; but at present I want to confine my remarks to the smelter. I said that this small profit we had made this year is an indication, and I think it is an indication, because it is the result of certain conditions, which have existed during that time, but which have not existed in previous years. These conditions are still with us, and there is no reason why they should not remain. Thus the profit we have made will, as far as one can see, in all probability be a permanent profit; and it is probably a profit which will be on the increase from year to year, both on account of the gradual improvement in all British Columbian affairs, and also on acount of the gradual improvements we are from time to time making in our smelting plant.

You have had explained to you on former occasions that our smelting plant is not everything which could be desired; it is rather an obsolete plant, and it is not built on good economical lines. This entails a great deal of hard labor, and consequently a great deal of expense in working. That might be altered if we were in a position to make a large outlay on the improvement of our smelting plant; but we are not. We have not sufficient capital to do this in one year; therefore we have to be content with doing it by degrees. We have done a little every year, and during the past year we have instituted several distinct improvements in the smelting plant, which will have an effect upon its economical working. At the present moment we have in contemplation, as you will see by the report, a new process. We say the Board have in contemplation a new process, but we say that we cannot state more than that we have our eye on a certain process, which claims to greatly reduce the cost of smelting and to greatly increase the material results. The shareholders will agree with the Board that it is not the province of this company, with its limited capital, to experiment with any new process, and it is not our intention to make any experiment whatever with regard to a new process. Many of us have had experience of new processes, and I think the experience of everybody is that in 999 cases out of 1,000 they are valueless, however much may be claimed by the inventors. What we intend to do is to assure ourselves that this process, which is in active operation on several smelting plants, is a success, and if we are absolutely confident that the process is a success on the smelters where it is in operation at the present moment, we may possibly consider its adoption. That is all that is meant by the paragraph.

The Emma Mine.

Now, I will pass away from the smelter, and say a word about the Emma mine. I do not want to go into any figures with regard to it, because the figures are small. I said a little about it last year when I addressed you. I said then that we anticipated this Emma mine would turn out a profitable investment, and there is no doubt it has turned out an exceedingly good investment. The benefits arising from that investment can never be set out quite clearly in any balance-sheet, because the greater part of these benefits appear in the smelting profits, and are not directly put down to the credit of the Emma mine. The chief benefit to us is from the supply of fluxing ore, which goes to our own smelter; but we have every reason to believe that the Emma mine will turn out quite a profitable investment, apart from the benefit which it confers on the smelter by the supply of fluxing ore. I do not want to make too much of it, but as far as it goes it is good, and from every promise it will be good in the future.

The Silver King Mine.

As to the Silver King mine, our agreement with Mr. Davys expired on 6th August last, and since that time the mine has simply been kept alive by a man, to whom we leased it, and whose operations have been on a very small scale. As you will see, however, we have made an arrangement with Mr. Davys, and I think it is a good arrangement. Mr. Davys, during the term of his lease, worked the mine down to the floor of the fifth level. The fifth level is the drainage pipe; if the water is not pumped out, it stands in the mine up to the fifth level. Mr. Davys is confident in his own mind that under the floor of the fifth level is a very considerable body of good grade ore. We have had several interviews with Mr. Davys during the last six weeks, and it occurred to us that, if he was so very confident of the existence of this body of ore, he would be willing to share with the company the expense of unwatering the mine, and to this he agreed. The position, therefore, is that Mr. Davys and the company are partners in the expense necessary for unwatering the mine down to the seventh level, and that the proceeds of any ore extracted between the seventh and fifth levels will be divided

equally between Mr. Davys and the company. The advantage of this arrangement to the company is that, in the first place, we are saved the expense of a mine manager, because Mr. Davys, being a partner, naturally expects no salary, and also there is the fact that the man who will be watching and directing the operations, is the man who is personally financially interested in the results. When that is the case, it is beyond all question that a man devotes greater energy to his work and is more careful in promoting economies than when he is simply the paid servant of a company several thousand miles off. If the unwatering process and the development consequent upon that process give indications of any body of ore below the seventh level, that body of ore will be absolutely outside of this arrangement. It will be the property of the company, and the company will be at liberty to make a fresh arrangement or to do anything that seems proper with regard to that ore. That is another direction in which this unwatering arrangement will benefit the company, because it will enable them to exploit the ground below the seventh level, which, at the present moment, they are unable to do. I may mention that the business of the company, since the closing of the accounts, has been extremely successful, if I may use such a word. Thus the small success shown in the balance-sheet has been certainly exceeded by the three months following the 30th June. All the transactions that have come to us are quite good. You will see that the item on both sides of the smelting account amount to over £200,000 in money. It must, therefore, be clear to you that when figures are as large as that, a very small reduction in the working expenses, and a very small improvement in the methods of smelting, may turn the small profit we have this year into a profit which is worth talking about—that is to say, a profit which may come within the range of dividend paying. I do not want to be too optimistic, but I think, generally speaking, that the whole of the business looks healthier at the present moment than it has done for some years past. Before I sit down I must take this opportunity of expressing the appreciation of the Board of the services of our excellent representatives on the other side. We think they have worked extremely well over there, and they have served the company in a manner of which I can hardly speak too highly. I will now formally move the adoption of the report and balance-sheet. (Applause.)

Mr. George Freeman seconded the motion, and congratulated the shareholders on the company having, as he believed, turned the corner, so that they might look forward to a very fair measure of success in the future. (Applause.)

The resolution was then put and carried unanimously.

On the motion of Mr. Freeman, seconded by Mr. Stratten Boulnois, Lord Ernest Hamilton was re-elected a director.

The auditor, Mr. Harry Barker, was also re-appointed.

On the motion of Mr. Ellis, seconded by Mr. Christie, a cordial vote of thanks was passed to the chairman, directors and staff, and the meeting separated.

In the report of Mr. J. J. Campbell, the business manager, it is noted that the tonnage obtained by Mr. Davys, the lessee of the mine, amounted to 4,341 tons, which contained an average of 3.66 per cent of copper and 21.4 ounces of silver. Mr. Davys' work was confined to the workings above No. 5 tunnel, and an attempt was made to get below No. 5 by syphoning out some of the water, but it was unsuccessful. Investigation of concentration methods has not yet led to satisfactory results. The development of the Emma mine produced 29,975 tons of iron ore for flux, of which 9,057 tons were used by the company and the balance sold to other smelters. The development of the Emma mine shows large reserves.

The stimulating effects of the Lead Bounty Act were not felt until February, 1904, and a considerable amount of the bounty due had not been paid at the date of the report. There has been no improvement in the market supply of profitable silicious ores, but since February the Hunter V. mine has supplied an ample amount of high grade limestone.

Mr. Robert R. Hedley, the smelter manager, reports that No. 1 blast furnace was operated for 204 days, and No. 2 furnace for 324 days, yielding bullion which contained 1,096,415 ozs. silver and 9,201 ozs. of gold. The copper matte carried 41,294 ozs. of silver, 130 ozs. of gold and 130,800 of copper, making the total gross value of the product for the year about $1,000,000. The maintenance of the plant has been heavy, amounting to $22,000, the chief item of which is the new method of connection between the railway cars and the gravity bins, whereby the labor cost of handling the ores, fuel and fluxes has been much reduced, aggregating a saving of over $12 a day. The balance sheet of the mine is as follows:—

.BALANCE SHEET.

Dr.	£	s.	d.
To Balance Forward	299,557	0	0
To Creditors:—			
Bank—on Loan Notes secured by charge on Company's stock, supplies, etc., etc.	40,538	9	6
In London	422	19	11
In British Columbia	5,922	18	2
	£346,441	7	7

Cr.	£	s.	d.
By Balance Forward	263,932	19	7
By stock of supplies, etc	7,177	12	7
" fuel, fluxes, ores, etc	17,160	19	4
Bullion and shipments	23,446	3	8
Debtors:—			
In London	50	0	0
In British Columbia	995	6	1
Cash—London and British Columbia	11,015	10	2
Profit and Loss	22,662	16	2
	£346,441	7	7

The General Account of the Company is given in the Report as follows:—

Dr.	£	s.	d.
To general expenses of the Company—in British Columbia and London	1,787	6	9
Debenture interest	1,473	12	0
Exchange	15	0	5
Balance, being profit (subject to charges of £4,550 13s. 2d., for maintenance of smelter, buildings, plant and machinery, and of £10 18s. 8d., for depreciation of office furniture in London) carried to balance sheet	6,258	7	11
	£9,534	7	1

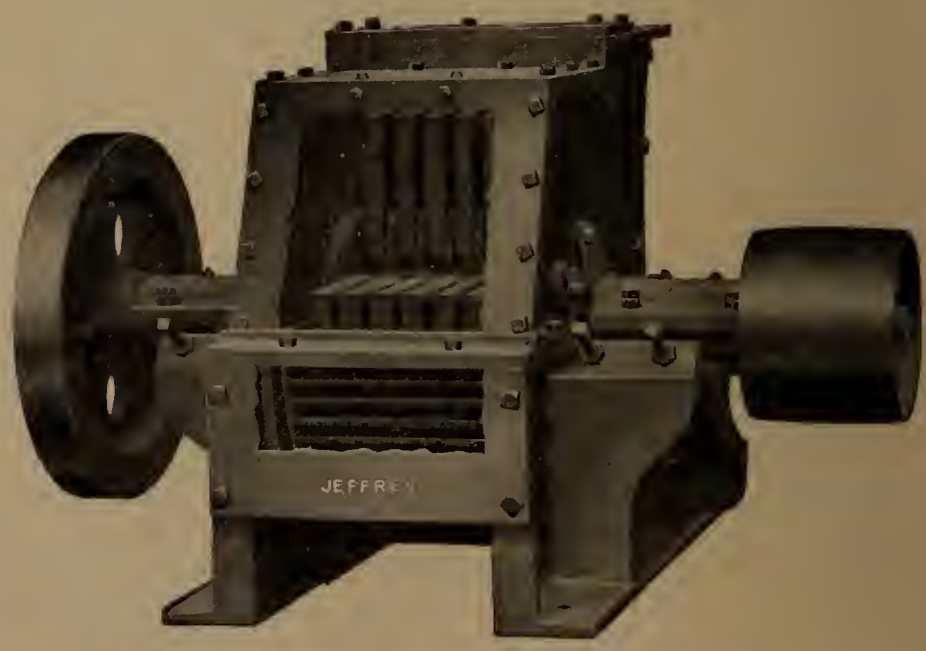
Cr.	£	s.	d.
By profit on mine account—Brought down	1,042	12	1
Profit on smelter account (subject to charges for maintenance, as above)—Brought down	8,394	8	6
Sundry receipts, including rents and other receipts in British Columbia, and transfer fees and interest in London	97	6	6
	£9,534	7	1

A New Type of Pulverizer.

The accompanying illustrations show a type of pulverizer which is designed for crushing or pulverizing materials such as coal, clay, shale, etc. The claim made for the type is that it is the simplest made, the action being similar to that of a hammer.

Its features are the "beater" hammer, the V-shaped screening bars, and the simple method of adjusting the beater arms to accommodate the wear of the hammer faces. The accessibility of the inner parts of the machine is one that will be appreciated.

The manufacture of this machine has been taken up by the well-known Jeffrey Mfg. Co., of Columbus, Ohio, who announce that they are prepared to make free crushing tests for interested people. The machine is no experiment, as many of them are now in successful use.



BOOK NOTICES.

The Sullivan Machinery Co. have just issued a very handsome and attractive booklet on Modern Practice in Air Compression. It is a trade catalogue, to be sure, but it is so well printed and the illustrations are so well executed that customers will have pleasure in consulting it.

Fraser & Chalmers, Ltd., of London, England, have issued a series of catalogues similar to those which the old American firm used to issue before it was merged into the Allis-Chalmers corporation. The general or index catalogue is of value as listing briefly the machinery supplied. The Canadian representative, Mr. W. Stanley Lecky, Montreal, can supply the detailed catalogues to inquirers.

The Engineering and Mining Journal have just published a volume by J. E. Clennel, B.Sc., on "The Chemistry of Cyanide Solutions resulting from the treatment of Ores," which will be welcomed by chemists having to do with the cyanide process. Methods for the determination of Free K Cy, total K Cy, H Cy and available K Cy take up about one-half of the book, and the various processes are commented on. The rest of the book is devoted to the estimation and action of Alkaline constituents, Reducing agents and inactive bodies.

The various complexities and ramifications of the subject are dealt with minutely and clearly, and the book is a necessity for the shelves of the metallurgical chemist.

The Mining Magazine for October is called its "Power Number," by reason of its descriptions of various applications of power to mining work. Beginning with a description of hoisting means and methods in the Joplin zinc district of Missouri, the reader is taken through hoisting in the coal fields of Indiana and Illinois, treated to dissertations on Electric Mine Haulage and Compresser Air Haulage, to conclude with descriptions of various gas engine plants.

As usual, the Mining Magazine is well dressed, and the articles well written as a whole, and the department called "The Mining Digest" is becoming more and more comprehensive and valuable each month. We know of no publication giving equal value for the low cost.

Through the courtesy of the secretary of the Montreal Board of Trade, a copy of "Official Bulletin, No. 19," issued by the Bureau of Provincial Information of the Province of British Columbia, has been received by the Review. The bulletin has been printed in the size of a handbook, which adds to its acceptability, but the putting of the Table of Contents at the end, rather than at the beginning of the book, is a matter of taste to which exception may be made by some users. To the Review, the book appears most admirable; the early mineral history of the Province is clearly and succinctly related, and the chapter on "Outlook on Zinc Mining," is of the greatest importance at the present time. The possibilities of platinum, cinnabar and iron are discussed briefly.

The chapter on "Smelting Works, etc.," by Mr. Ernest Jacobs, is a careful compilation of existing data regarding the present smelters of the Province, and of those other works, such as concentrating plants, which are of special interest in connection with the output of the Province. The book was specially gotten up for the St. Louis Exhibition, but it forms a valuable and permanent record.

Mining Share Market.

Outside of three or four stocks, there is but little change in prices, the most active being Granby Consolidated, which has advanced in sympathy with other copper stocks and become quite active in the Boston market.

The dividends on St. Eugene and Canadian Gold Fields have had a beneficial effect on the market generally, and very few shares of any British Columbia companies are offering, but the public has not yet become sufficiently interested to create any demand.

The industrial stocks have all been fairly active, and show material advances for the month. This is due to the continued improved trade outlook and an increasing speculative demand, following the movement in the similar class of securities in the New York market, and the plentiful supply of money available for loans.

The following list shows the quotatious for the month ending Saturday, November 26th, as supplied to the Review by **Robert Meredith & Co., 57 St. Francois Xavier Street, Montreal:—**

Par value of shares.		Asked.	Bid.
.10	Canadian Gold Fields Syndicate	.07½	06½
5.00	Cariboo Hydraulic	.75	—
1.00	Centre Star	.25	.24½
1.00	Deer Trail Consolidated	.02	—
1.00	Giant	.03½	.01
10.00	Granby Consolidated	5.50	5.25
10.00	Montreal and Boston	1.00	—
1.00	North Star	.02	—
1.00	Payne	.04	.02
1.00	Rambler Cariboo	.17	.16
1.00	Republic	.03½	—
1.00	St. Eugene	.50	.47½
1.00	War Eagle	.12½	.11
1.00	White Bear	.04¾	.04¼
100.00	Nova Scotia Steel (common)	.66	.65¾
100.00	Ditto ditto (preferred)	—	1.05
100.00	Dominion Coal (common)	.62½	.61½
100.00	Ditto ditto (preferred)	1.16	1.15
100.00	Dominion Iron and Steel (common)	.17¾	.17½
100.00	Ditto ditto ditto (preferred)	.48	.47
——	Ditto ditto ditto (bonds)	.77	.76¾

ELECTRICAL NOTES.

Three Westinghouse 62½ kilowatt engine type generators, which have been in service in the basement of the New England Building, in Cleveland, Ohio, have recently been subjected to a severe test. A fire occurred in the basement where the generators were installed, and completely burned away the insulation on the outside of the field coils; the fire department played on these machines for over one hour. Within one hour from the time the water was turned away from the machines, one of them was in operation and carrying its full rated load. The second machine was put in operation later, and at the present time these two machines are operating under the load normally carried by all three of them.

The fire-proof insulation of the field coils withstood the fire perfectly, even though the outer protected coverings were entirely consumed. Electrical machinery, as usually constructed, is scarcely expected to stand a fire and water test, but it appears that such a guarantee might have been made on these generators.

A somewhat unique departure from established methods in electric traction has recently been undertaken at Warren, Pa. The Warren & Jamestown Street Railway Company is equipping an A. C. single-phase electric railway system to operate between Warren, Pa., and Jamestown, N.Y., for which power will be supplied by gas engines operating upon natural gas. The equipment is now being constructed by the Westinghouse Companies at East Pittsburg, Pa.

The power station will be located at Stoneham, Pa., two miles from Warren. The initial equipment will consist of two Westinghouse gas engines, each of 500 brake horse power capacity. They will be of the horizontal, single-crank, double-acting type, direct connected to two 260 kw. Westinghouse generators, furnishing current at a voltage sufficient for direct use upon the high tension transmission line. The power equipment also comprises a 55 h.p. Westinghouse gas engine for operating air compressor and exciter unit. Natural gas will be used, furnished by the local distributing company. In this district the gas has a calorific value of about 1,000 B. T. U. per cubic foot.

Transformer substations, five in number, will be located along the right of way. These will receive the high tension current from the transmission line and reduce the voltage to such an extent as to render it more suitable for use in single-phase motors. The present motive power equipment will comprise four quadruple sets of Westinghouse single-phase motors, each approximately 50 h.p. capacity.

An interesting feature of the system is the arrangement for operating the alternating current motors upon the direct current trolley lines within the city limits of the termini.

The Warren & Jamestown Street Railway is not a newly organized system, as it has operated part of the present lines for a period of eleven years. Three years ago the company began experimenting with the use of gas power, with sufficient success to influence them in the now exclusive adoption of gas engines for their entire power generation. The operation of the new system will be watched with much interest by the engineering public, and its success will mark an important advancement in modern electric railroading.

PERSONALS.

Mr. R. A. Hadfield, head of the important Sheffield firm of steel manufacturers, has been elected to the presidency of the Iron and Steel Institute.

Vice-president Wood, of the International Nickel Co., was in Ontario during the month and inspected the works at Copper Cliff and the properties of the company.

Mr. W. Shoemaker, superintendent of construction work at the furnaces of the Nova Scotia Steel and Coal Co., at Sydney, has resigned, and will return to Pennsylvania.

Mr. F. L. Wanklyn, vice-president of the Dominion Coal Co., has been acting as general sales agent of the Dominion Coal Co. since the resignation of Mr. Abner Kingman.

Mr. F. T. Finucane, for many years connected with the Bank of Montreal, both in Eastern and Western Canada, has resigned, and will enter into business with Mr. Charles Sweeny.

Mr. John Hays Hammond, the well-known American mining engineer, has been very ill at his summer home, near Gloucester, Mass. He is now reported out of danger and on the way to recovery.

Mr. Patrick J. Dermody who, for years, has been the reliable and efficient foreman at the Granby mines, has accepted a similar position with the Providence Mining Company on November 1st.

Mr. Willard N. Sawyer, of the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, has been appointed to succeed the late Cornelius Shields as general manager of the Lake Superior Corporation.

Mr. Hugh Fletcher, of the Geological Survey, is still in the field in Cumberland County, N. S. Mr. Fletcher enjoys the reputation of being the first of the staff to leave in the spring, and the last to return in the fall.

Mr. J. Obalski, Inspector of Mines for the Province of Quebec, has been awarded a gold medal from the St. Louis Fair for the completeness and informing character of his annual reports to the Quebec Government.

R. S. Dahl, of the Central Technical School, London, Eng., has been appointed Professor of Engineering in King's College, Windsor, Nova Scotia. Prof. Dahl has achieved success and reputation in the line of original research work in electricity.

Mr. Charles H. Wilkinson, of London, England, arrived in Canada early in the month, and has been looking into Kettle River Railway matters. Mr. Wilkinson will be remembered as one of the early promoters of the White Pass and Yukon Railway.

Mr. Henry M. Whitney, of Boston, was recently in Newfoundland with Mr. B. F. Pearson, of Halifax, where the two gentlemen arranged to transfer to representatives of the Messrs Harmsworth, the big London firm of publishers, the large and valuable pulp lands now owned by Mr. Whitney.

Prof. Ernest Rutherford, Ph.D., of McGill University, has been awarded the Rumford Medal by the Royal Society of Great Britain for his researches on radium and radio-activity. The Rumford Medal is one of the highest marks of distinction given in the world; it is awarded every two years to the author of the most important discovery, or improvement, in heat or light.

Mr. A. C. Garde, manager of the Payne mine, severed his connection with that company on the 1st of November. He was succeeded by Mr. G. F. Ransom, son of one of the Montreal shareholders. The closing of the mine and the leasing of both mill and mine to former employees are indications that nothing will be doing by the company for some time.

Mr. Horace Mayhew, of Chester, England, spent the month of November in Canada looking into the investments which he has made in this country.

Mr. Mayhew is one of the owners of the Alice mine, near Creaton, B. C., where a new wire-rope tramway has recently been installed and put in operation. He is also a shareholder in the B. C. Standard Company, which operates the Hunter V. mine near Nelson. The Hunter V. was started to supply limestone as a flux for the British Columbia smelters, but an increase in its gold values has dignified it so that it may be called a gold mine.

Mr. Mayhew is also president of The Cape Breton Coal, Iron and Railway Co., which acquired the Moseley and other areas at Port Morien in June last, and he went to Cape Breton from British Columbia, where he was joined by Mr. Herbert Gladstone, a director of the C. B. C. I. & Railway Co. Mr. Gladstone is a son of the late Right Hon. W. E. Gladstone. It is understood that business will keep both gentlemen in Cape Breton for a few days.

INDUSTRIAL NOTES.

The A. S. Cameron Steam Pump Works have gotten out a miniature catalogue, which presents some of the distinctive features of this make of pump; the differential plunger sinking-pump and the vertical boiler feed pump present attractive features in their make-up and mechanical care which commend them to users of this class of machinery.

The Dominion Peat Products Company, Ltd., has come to financlal grief. This company was organized with a capital of $100,000 to work a peat bog in the vicinity of Newington, Ont., and obtained $20,000 in cash, which has all been spent. More capital is needed for the plant, and to pay the liabilities, which amount to $3,050. The balance of the capital stock is not saleable, and re-organization or liquidation are the alternatives. Dr. Spencer, president of the company, states that a syndicate is ready to take over the property and re-organize the company.

The Wellman-Seaver-Morgan Company, Cleveland, Ohio, was recently awarded a contract to construct two large coal-handling machines for the Boston Coal Dock & Wharf Co., Duluth, Minn.

The machines will consist of two conveyor bridges, each about 350 feet long, including front and rear cantilevers. The machines will be designed so that coal may be screened and loaded into box cars as well as unloaded from vessels, and will be built to be operated by steam. They will be equipped with 2-ton Hulett patent excavating buckets, and machinery designed to give maximum speeds of operation. The structural work will be of steel throughout, and the machines will be self-propelling along the dock.

A corporation composed of Montreal men has formed "The St. Lawrence Coal Company," to acquire and operate what has been known as the "Collins Coal Areas," in Cape Breton. The area obtained contains about 700 acres, which are to the westward of the General Mining Association's ground, and run to the east shore of the Little Bras d'Or. Three known seams of workable coal are comprised within the area: the Edwards seam, the No. 3 seam and the Collins seam, and each has been more or less developed.

The company has been capitalized at $500,000, one-half of which is six per cent. preferred stock, and the balance common stock. The president of the company is Mr. James Robinson, Montreal, and the engineer is Mr. Charles Brandeis, who is also vice-president of the company.

The Ottumwa Box Car Loader Co., of Ottumwa, Iowa, whose advertisement appears in our pages. shipped one of their latest Improved machines last month to the Dominion Coal Co., at Glace Bay. This loader is guaranteed to handle lump coal at the rate of 150 tons an hour, and load it in box cars without damage to either the coal or the cars. The Ottumwa Loader has proved itself valuable to many companies in Canada. The following coal companies are using it:—The International Coal & Coke Co., Coleman, Alberta; Canadian Pacific Railway, Fort William, Ont.; Lake Erie Coal Co., Walkerville, Ont.; Acadia Coal Co., Stellarton, N.S.; Intercolonial Coal Co., Westville N.S. The machine has been on the market now for about four years, and the large number of loaders in use prove it to be no experiment but an actual saver of time and money.

The annual general meeting of the St. Eugene Consolidated Mining Company, Ltd., was held at the company's office on the 8th day of November. The report presented of the directors was in marked contrast to those of the last two years. The cash surplus on the 30th day of December, 1903, was $131,000, after paying off a liability of $26,000. A quarterly dividend of two per cent was declared, payable on the 5th day of December.

Exclusive of the dividend, which is payable on December 15th, the Company has formerly paid dividends to the amount of $210,000. The enormous output of 3,000 ton of concentrates per month was diminished during August, September and October by a shortage of water, which has crippled building operations. To remedy this, a large pumping plant is being installed to pump Moyie Lake to the concentrator, and the 200 horse-power engine is being added to the plant, giving additional power.

Messrs.Wm. Simons & Co., Ltd., Renfrew, Scotland, launched on the 10th of November, complete, with steam up ready for work, the twin-screw, light draft, bucket ladder hopper dredger "Manar," built to the order of the Secretary of State for India.

The vessel is fitted with two sets of triple-expansion surface condensing engines, supplied with steam from two steel boilers constructed for a working pressure of 160 lbs. per square inch, and powerful manoeuvring winches are placed at bow and stern for manipulating the dredger when at work. Independent hoist gear is provided for controlling the bucket ladder. Ample accommodation is also provided for officers and crew.

The "Manar" was constructed under the direction of Sir A. M. Rendel, K.C.I.E., consulting engineer for the Indian Government, and under the direct superintendence of Mr. Seymour B. Tritton, M. Inst. C. E., London, assisted by Mr. Gaze, resident inspector.

MINING NOTES.

NOVA SCOTIA.

The Nova Scotia Steel and Coal Co. has made a claim for a bounty on iron smelted at the Sydney Mines Furnace since August 31st. The amount smelted since that date, on which bounty is asked, is 3,575 tons.

The Hub, or No 7 colliery of the Dominion Coal Company, has stopped coal cuttlng until navigation re-opens next spring. During the winter, work will be confined to driving the deeps and removing pillars. During the season 500 men were employed, but 200 will suffice for the winter's work.

Parrsboro, N.S., is endeavoring to assist in every way the Standard Coal and Railway Co. which has been chartered to build a railway from Parrsboro to Truro. The new line would open up quite a section of new country, and would permit a large amount of the coal mined at Maccan and River Hebert to be shipped by way of the Bay of Fundy.

Since August the Dominion Coal Co. has been working single instead of double shifts at its various mines, and announces that it is saving money thereby. The requirement of a double shift was the necessity of keeping pace with the contracts which the company had made, and now that many of their summer delivery contracts have been filled there is no probability that a double shift will be again worked until next season.

The Fundy Coal Company, Cumberland County, N.S., has applied for a charter to permit of incorporating a company which shall include the grindstone quarries and the coal mines which they have been operating thus far independently. The output of grlndstones is very considerable, and the tonnage of the coal mines is gradually increasing. The shareholders are from Providence, R.I., as well as from Nova Scotia and New Brunswick.

The importance of locating schools of engineering in the vicinity of large engineering works is being daily recognized by universitles and large institutions of learning. One of the latest examples is the movement of King's College, Nova Scotia, to hold lts school of engineering at Sydney, C.B. The first year of the engineering course will be given at King's College, at Windsor, N.S., but the other three years will be given at Sydney, C.B., where the degree will be conferred.

Springhill, N. S., is the headquarters of the Maritime Mining Students' Association. The organization of this association and its meetings are both interesting and instructive as may be gathered from some of the topics dlscussed at its last meeting, when papers on the following subjects were read: "Entering a mine for exploration after an explosion," "The bord and pillar methods of working," "Miners' Diseases," "Blasting," "Fire Damp," "Explosions and Afterdamp" and "The use of Explosives in Mines."

The Cumberland Coal & Railway Company are making important improvements at their West slope; the new large boiler house, new boilers and new machines for tipping the boxes on the tipple are among the changes which are now making. An endless picking belt has also been installed. Additions have also been made to the fire protection plant in the shape of a new steam pump and the location of hydrants about the works and lumber piles. The equipment of the West slope is rapidly becoming equal to that of any coal mine operated anywhere in Canada.

The Dominion Coal Company's output from the first of the year, with the corresponding figures for the same period last year, ls as follows:—

	1903.	1904.
January	269,571	198,406
February	258,130	178,246
March	200,144	232,245
April	256,180	232,073
May	232,749	301,240
June	277,158	331,090
July	263,521	259,355
August	236,811	293,909
September	252,268	275,834
October	294,196	294,038

Hallfax capltalists are reported to have purchased the Pictou Smeltlng Works which were built with considerable splurge a few years ago. The company which will operate the works is known as The Inverness Copper Co., Ltd., who propose to increase the capacity from 100 tons to 300 tons per dlem. It is reported that some $220,000 have been expended on the plant, but this report lacks confirmation. The Inverness Copper Company is the name of a concern owning a large area of territory at Cheticamp, C.B. If the smelter can secure an adequate supply of ore and is managed by a competent man, it should at least pay expenses and would probably make a satisfactory profit; as to whether the ores from the Cheticamp district can stand transportation to Pictou, and the expense of two staffs instead of one, is a matter which will shortly be demonstrated.

NEW BRUNSWICK.

Some Moncton people are opening a coal seam which crops at Dunsinane, near Anagance.

The New Brunswick Petroleum Company has ceased its boring operations for the winter, but the yielding wells will be pumped throughout the season.

The Maritime Copper Reduction Company, operating at Goose Creek, is in trouble on account of the refusal of shareholders holding some 50,000 shares to consent to a further development of the property; the tie-up is embarrassed by the refusal of these shareholders to sell their stock. It will be remembered that some of these shares are owned in the United States, chlefly in New York.

The Dominion Coal Company completed, during the month, the building of the best wharf in the harbor of St. John; the coal pockets have yet to be erected. The wharf ls 300 feet long with a width of 80 feet; the coal pocket will be 240 feet long and 30 feet wide. There will be a power-house on one end of the wharf, but as to whether steam or electricity will be utilized has not yet been decided.

Application for incorporation has been made to the Legislature of New Brunswick by "The New Brunswick Iron Company, Limited." The provisional directors named in the application are: John S. McLennan, of Sydney, C.B.; Charles W. Young, of St. Stephen, N.B.; Leonard B. Knight, of St. John, N.B.; A. D. Wetmore, of Truro, N.S.; and Charles V. Wetmore, of Sydney, C.B. The capital is to be $1,000,000 in 10,000 shares of $100 each, and the chief place of business is to be Lepreaux, Charlotte County, N.B.

The death of Mr. E. B. Ketchum removes from New Brunswick one of its most active and enterprising citizens. The variety of activities in which this gentleman was engaged was considerable; he was a successful mariner, trader, manager of a cotton manufactory, and an industrial man. He was a native of St. John, N.B., and was seventy-three years of age when he died. Before he was twenty-one he was in command of a full rigged ship sailing from St. John; at the age of twenty-five he entered the employ of the Albert Mining Company, eventually becoming its manager. The limited mining history of New Brunswick loses quite an important figure in the death of Mr. Ketchum.

Dr. Matthew, of St. John, N.B., has sold his valuable collection of Cambrian fossils to Mr. William McKenzie, of Toronto, who has presented it as a gift to Toronto University. The price paid for the collection was $2,500.

The collection represents the gatherings made since 1877 for a period of twenty-seven years, and consists of the best representation of the life of the Cambrian period, as shown in New Brunswick, Nova Scotia, Cape Breton and Newfoundland rocks. The collection contains 130 genera, 13 sub-genera, 380 species, 41 mutations and 68 varieties; it consists chiefly of sea shells, worms and crustaceans. Toronto University is to be congrautlated upon the possession of such an exceedingly valuable collection.

QUEBEC.

A promising deposit of iron ore has been discovered on the farm of Mr. William Talmage, near Sweetsburg.

The Bell's Asbestos Co., Ltd., announce that they have been again favored with the contract from the Admiralty for the supply of their asbestos specialties.

The Hamllton Powder Company had an explosion at its works at Windsor Mills this month, by which two workmen lost their lives, and one small building was wrecked.

The McKenzle Trading Company has been absorbed by a new corporation as a result of the mineral discoveries which have been made in the northern part of the province, and to which reference is made in our correspondence. The new company will send an expedltion into the Lake Chebogamoo dlstrict next spring.

ONTARIO.

One of the Canadian Copper Co.'s plants at Copper Cliff is out of commission in consequence of a "freeze up."

The Burgess phosphate mines shipped 100 tons during the second week of November.

The old mill at Craigmont, formerly used to concentrate corundum, has been destroyed by fire.

The water power at Turbine is now controlled by the Huronian Company, whose first installation will be of 6,000 horse power.

It is reported that the Chambers-Ferland nickel mine, in the Temiscamingue section, has been sold to the International Nickel Co. for $400,000.00.

The delay at Copper Cliff occasioned by the breaking of the electric crane has been overcome by the installation of a new crane, and the furnaces are all now running satisfactorily.

The local newspaper at Haileybury is authority for the information that Duncan T. McCann, of Eganville, has bought a share in H. Wright's silver claim on Kerr Lake, near Haileybury.

The Laurentian and Volcanic Reefs Mining Companies are constructing a new road from Dinoric station to the mines, in the Manitou district. The length of the road is eighteen miles.

The water power of the Wahnapitae River will be harnessed this winter to an electric generator which will, next spring, supply the town of Sudbury with light and electric power for the water-works pumps.

The Government paid out about $75,000 for bounties on crude oil in October, the greater part of which went to Ontario. It is expected the total disbursement on this account for the twelve months will amount to $300,000.

Messrs. Duncan, Dunfield and Wilkinson struck a large gusher in Moore Township, near Petrolea, on October 31st. The column rose to a height of forty feet, and marks one of the largest flows of oil and gas ever known in Ontario.

Mr. W. E. H. Carter, one of the Bureau of Mines Inspectors, is authority for the statement that A. L. 282, known as the "Sunbeam" mine, has recently sent two gold bricks to the assay office; each was of the reported value of $3,000.

W. E. H. Carter reports that new and important bodies of high grade hematite have been found on the line of the Algoma Central Railway, in the lower levels of the Williams Iron Mine. The clean ore measures twenty-three feet across, and there is an additional ten feet or more of second quality ore.

The City of Belleville, after making a bonus agreement with the Iron and Steel Company of Canada, recently attempted to collect taxes from the company. An injunction to restrain the city from attempting to collect was recently granted by the Court to the Iron and Steel Company, which will now go as before.

During the past season Professor W. L. Goodwin, director of the School of Mines at Kingston, and J. W. Bain, of the School of Practical Science, Toronto, have held ten schools of instruction at mining camps in Ontario. Instruction was given in geology and mineralogy and night lectures with lantern views, obtained by an acetylene plant.

Mr. E. D. Ingall, Statistician of the Dominion Geological Survey, reports great stagnation in the copper mining industry in the region near the Soo, and the Bruce Mines. The closing down of the Bruce property by the English corporation which owned it, and the litigation which has followed the Rock Lake property, is probably the cause of the present stagnation.

As a result of Dr. Haanel's trip of investigation made to Europe last winter in connection with the electric smelting of iron ores, two French gentlemen, Paul Koch and Jules Weill, have been looking over the Chat Rapids and the iron ores of the section to see what possibilities there are in Canada for the manufacture and sale of electrically-made steel and iron goods.

The Divisional Court at Toronto has dismissed the appeal of the defendants in the case of Cameron vs. the Mikado Gold Mining Co. The lower court had awarded the plaintiff $1,411.03 on an agreement whereby he undertook control of the boarding house and stores of the company; subsequently it was sought to terminate the agreement. Judge Idington awarded the plaintiff the above amount, which award has now been confirmed.

From an English paper we learn that a corporation known as "The London and County Trust" is going to raise £1,000,000 sterling, for the purpose of developing mineral claims and concessions for a railway in the Rainy River District. The ignorance and folly of the promoters may be judged when it is stated that the scheme proposes to obtain water from Lake Simcoe for the purpose of generating electricity to be used in the Rainy River country.

The Stirling Co., of New Jersey, has obtained a judgment against the Nickel-Copper Co., of Hamilton, for $68,231. The plaintiffs about two years ago advanced $65,000 to the defendants on options, but the latter were unable to fulfil their obligations, hence a suit to recover the money with interest. The Stirling Co. will not be able to realize on their judgment for a time, as Mr. McConnel, of Ottawa, has a mortgage on the Nickel Co.'s property for about $200,000 which takes priority. The Hoepfner Refining Co., composed of some of the officers of the Nickel Co., have also put in a claim of $48,000 for rent, for which they made a seizure of the property.

It is reported that the Lake Superior Company has received enough orders from the Dominion and Ontario Governments to keep its rail mill running at its full capacity until June, 1905. The Dominion Government made a contract for 10,000 tons for the Intercolonial Railway, and it is stated that the Finance Minister has agreed to purchase all rails needed by the Government railways for relaying purposes during 1905, amounting to about 35,000 tons. The Ontario Government has contracted for all rails needed on the Temiscamingue line, which amount to between 15,000 and 20,000 tons. These large contracts, with the smaller ones that have been made, will take all the output until the middle of next year.

A suit has been instituted between a number of farmers and the Canada Corundum Co., by reason of an agreement in respect to certain mineral rights to corundum lands in the township of Carlow, under which plaintiffs claim to be entitled to shares in the Corundum Co., and to the payment of certain money. The defendants allege that plaintiff's abandoned their priority and suffered defendants to take out mining leases of said lands. At the trial in May last, Chief Justice Sir Wm. Meredith dismissed the action. On appeal this judgment has been varied by directing that the dismissal of the action is without prejudice to the right of any of plaintiffs to institute another action against defendant Craig for obtaining leases of the mining lands in question, and subsequently made to him by his co-defendants. In other respects the judgment of the trial judge is affirmed.

Professor W. G. Miller, provincial geologist for Ontario, has recently returned from his season's work in the field. His time was largely occupied in mapping out the valuable mineral discoveries which have been made along the line of the Temiscamingue and Northern Ontario Railway between North Bay and Haileybury. These deposits include native silver, cobalt, arsenic and nickel. Now that the railway is open for traffic five mines are shipping, and during the past two months many thousand dollars worth of the minerals specified have been sent to New York for treatment. New discoveries are constantly being made, and it is reported that one of the mines has been sold to New York capitalists. A new type of deposit of native silver has been found. The first deposits were in the slate or brecciated material, now the metal has been found in the diabase or gabbro. Prof. Miller has also made a preliminary investigation of the iron range discovered in the township of Boston, on the Blanche River. The ore is magnetic. The range is not so wide as at Tewagami.

The following mining leases, heretofore granted in Ontario, have been cancelled under section 36 of the Mines Act:—

Lease dated 16th May 1899, to Otto Taubert, for mining location K 475, being forty acres, and location K 476, being forty-two acres, near Seine River, in the district of Rainy River, for the term of ten years.

Lease dated 16th May, 1898, to the Bad Vermilion Gold Company, Ltd., for mining location G 213, being 183 acres, north of Seine River, in the district of Rainy River, for the term of ten years.

Lease dated 6th July, 1897, to George Heustis Campbell, for mining locations G 179 being 160 acres, G 180 being 213 acres, G 181 being 80 acres, G 182 being 18 acres, and G 183 being 40 acres, all near Bad Vermilion Lake, in the district of Rainy River, for a term of ten years.

Lease dated 10th May, 1899, to John M. Baer, for mining location K 602, being 60 acres between Shoal Lake and Mild Potato Lake, in the district of Rainy River, for the term of ten years.

Lease dated 27th April, 1898, to Donald Campbell Taylor, for mining location G 128, being 68 acres, and G 129, being 80 acres, being near the eighty-second mile on Niven's South Base Line, in the district of Rainy River, for the term of ten years.

Lease dated 17th June, 1897, to Solomon Lorie, for mining location K 477 being 40 acres, K 478 being 40 acres, and K 483 being 40 acres, near Seine River, in the district of Rainy River, for a term of ten years.

Lease dated 1st May, 1899, to Ernest William Calnek, David Morrah, and Howard Rosiing for mining locations G 216 being 48 acres, G 217 being 40 acres, and G 218 being 34 acres, near Bad Vermilion Lake, in the district of Rainy River.

Lease dated 3rd March, 1897, to Ernest Williiam Calnek and Henry Cockman for mining iocations K 367, being 40 acres, near Seine River, in the district of Rainy River, for a term of ten years.

Lease dated 14th August, 1899, to George Stewart for the mining location known as the north haif of iot number seven, containing 149½ acres, in the second concession of the township of Aberdeen, in the district of Algoma, for a term of ten years.

BRITISH COLUMBIA.

Examinations of assayers for licenses to practice in British Columbia are to be heid at Victoria on December 5th.

It is reported that the Boundary Faiis smeiter wiii blow in its second furnace on the first of December.

The St. Eugene Mining Company has declared a quarterly dividend of two per cent., payable in December.

The Estella group on Tracey Creek, East Kootenay, is to be again worked after having been ciosed for some time.

F. Maicoim has taken a contract to drive 600 feet on the tunnel of the Ruth Mining Company. It will be driven by air drills.

After two years of idleness the Moiiie Gibson mine in the Siocan has recommenced work under the superintendence of Capt. Trethewey.

The Chapieau mine, near Siocan City, wiii be worked ali winter, and the high grade ore wiii be raw-hided down to Siocan City.

The sixth annual meeting of the Centre Star Co. was held in Toronto on the 29th of November, too late for a notice to appear in this issue.

Henry Nicholson was appointed attorney in the province for the Waterloo Consolidated Mining and Miiiing Company on November 8th.

The Senator group in the Boundary country is shipping a carload of ore a day with a force of tweive men; the ore is sent to the railway in waggons.

The Ivanhoe and the Idaho are the oniy concentrators in the Sandon section which are at work at present; the scanty water suppiy is given as the reason.

The Wild Horse Creek section of East Kootenay cieaned up $30,000 from hydraulicing for the season of 1904, which is an increase of 50 per cent. over 1903.

The lessees of No. 1 and No. 2 tunneis at the Payne mine have concluded their lease, during which they have shipped about 150 tons of good grade ore.

Operations at the Bad Shot mine in the Lardeau are reported to be ciosed for the season, after taking out thirty tons of high grade ore in forty-five days.

The Mother Lode converters are treating copper matte from the Montreal and Boston, and the Trail, smelters, in addition to converting their own mattes.

The oid Stemwinder mine, in the Boundary District, made the first shipments of ore in its history this month. The ore went to the Boundary Falis Smelter.

Ernest Levy was appointed attorney for the Le Roi No. 2 Limited in the province on November 8th, in iieu of Paul S. Couldrey, whose appointment was revoked.

The Siocan Star is now the heaviest shipper of the Siocan Division; it is sending out from one to two carioads of ore daily. The ore is shipped directly from the mine.

The British-American Dredging Company, of Atlin District, are having a second and iarger dredge built, which is to be completed and set up on the property next spring.

Some of the recent changes which have occurred at the Le Roi smelting piant indicate a desire for economy; two furnaces are now being operated in piace of six as formerly.

Reports from Sandon, and the Siocan generaiiy, say there has never been a time within the recoiiection of the oldest miners when the snow has held off so iong as it does this fall.

The location surveyors for the finai iine of the railway from Goiden to Fort Steele have finished work on the vicinity of Goiden and have moved camp twelve miles up the river.

Mr. James Cronin, manager of the St. Eugene mine, has been elected to the directorate of the Centre Star and War Eagle companies, vice Mr. C. H. Gooderham, recently deceased.

Reports from the Ymir mine are to the effect that the outlook is much improved, and that the new manager, Mr. S. J. Speak, expects the property to soon return to a paying basis.

The Sullivan smeiter outfit at Marysviiie, East Kootenay, is hard up for funds, and proposes to mortgage ali its property for $400,000 with which to complete the smeiter and start work.

The Kootenay Ore Company at Kasio, and the Monitor mine at Roseberry, are each erecting magnetic zinc separation plants; the former will be on Kootenay Lake and the latter on Siocan Lake.

Reports from Grand Forks, B. C., make the statement that a smeiter man from Coiorado has secured contracts for a daiiy tonnage of 700 tcns, and wiii at once proceed to erect a custom smeiter.

The Rossiand papers say: "The examination of the Snowshoe mine, near Phoenix, is being continued with humorous solemnity, but the prospect of its being merged with the Le Roi is the same as before."

The high grade mines in the Boundary are coming to the front; at present sixteen ciaims around Greenwood are working with a total force of 150 men. This number of men is being steadiiy added to week by week.

On the 14th instant, Thomas and James Kennedy, of Nova Scotia, working in a coai mine at Canmore, in British Coiumbia, were biown to death by the expiosion of a iamp in the dressing shed in which they were.

The Britannia mine at Howe Sound is asking its shareholders to agree to increase the capitai from $250,000 to $625,000; the chief reason stated is that funds may be on hand to carry forward the work of development.

Shareholders in the Morrison mine, which was included in the combination out of which arose the Montreai and Boston Consolidated, are asking for information from that company; they say they have not received shares in the new company.

The Granby Company on the first of the month started sinking a winze from the 300 feet ievel of the Oid Ironsides property; this winze wiii be sunk 100 feet. No. 2 shaft is already sunk to the 400 feet levei, but no ieveis have been turned off.

The shortage of water in October handicapped the operations of the Rossland Power Company in its concentrating work at Traii, but the recent rains have given pienty of water and the Power Company's miii is now free from the water difficulty.

A. B. W. Hodges, generai superintendent of the Granby properties, has devised a new electric arrangement for his six stacks by means of which they are rendered seif-charging; five of the six furnaces have aireadý been equipped with this device.

The Strathmore mine, near Greenwood, has struck a high grade galena carrying native gold and siiver. Ore values are said to average $100 a ton. Several tons of this high grade ore are now on the dump, and will shortly be shipped to the smeiter.

Mr. H. Craven, of Rossiand, has commenced hydraulic operations on the west bank of the Columbia River, two miles beiow Waterloo. The necessary head is obtained by pumping, at a cost which is said to be fifteen cents per cubic yard; the yield is stated to be forty cents per yard.

The Southeast Kootenay Coai and Petroieum Company is the name of an organization which has been formed to work coal and oil lands in East Kootenay district. This company has taken an American charter, and is capitaiized at $250,000, in 1,000,000 shares of twenty-five cents each.

The Payne mine has leased that portion of the mine lying between the second and the fifth levels to Messrs. Brown and Smith, and the miii has been leased to Mr. Little, the superintendent of the miii. Messrs. Brown and Smith were foreman and timekeeper, respectively, before the shut-down.

Mr. R. D. Fetherstonhaugh, of Atlin, is authority for the statement that the gravel mines of Spruce Creek, Atlin, can be worked more cheaply and in a more satisfactory manner by a steam shovel than in any other way. He is going to put on a 1,000 yard Marion steam shovel and try it next spring.

The Montreal and Boston Consolidated is reported to have "in sight" and blocked out some 2,000,000 tons of ore throughout the aggregation of claims which it controls. The average value of this ore is stated to be from 1½ per cent. to 1¾ per cent. of copper, and $2.00 per ton in gold, or about $6.00 smelters' gross assay value.

The Jumbo mine, near Rossland, is increasing its output steadily. October amounted to about seventeen tons, and it is expected that this will be doubled by the beginning of 1905. The Great Northern Railway is to construct a spur line to the Jumbo property to permit the rapid loading of Jumbo ores into the railroad cars.

The Mohican, in the Lardeau, has completed the laying in of its winter supplies. This mine has two distinct streaks of ore in the same vein. One is a chalcopyrite carrying low values in silver (50 ozs.), the other is a galena which is often of high grade, picked samples showing eighty-two per cent. of lead, with 340 ozs. of silver.

Atlin district reports an increase of $100,000 for 1904 over 1903, when the amount totalled nearly $500,000. The largest clean up was made by the McKee Creek Company, which shows $58,000 for the season; next in order are the Pine Creek Power Company, the North Columbia Gold Mining Co., and the British-American Dredging Company.

The report which has been current in Western newspapers that the Canadian Pacific Railway Co., had purchased the plant of the Cascade Power Co., at Cascade, with the intention of erecting a smelter at that point, is entirely without foundation. That offers of the plant to the Canadian Pacific Railway have been made is not denied, but the purchase is not contemplated.

Our advices inform us that the Le Roi Company will continue to use the Northport smelter, on which extensive repairs are making. A large force of men is engaged in making repairs to the furnaces and engines, and the buildings have had new roofs put on. It is also rumored that additional stacks will be built, and that the Snowshoe mine has contracted to deliver 100 tons of ore daily.

Early in the month the Providence mine, near Greenwood, reported a strike of high grade ore on a vein hitherto unexploited. The vein was stripped for 300 feet in length, and averages between ten and twelve inches wide; assays made showed $10.00 per ton in gold and $95.00 per ton in silver. The character of the ore differs from that in the workings of the old vein, carrying much native silver.

The charge made against Mr. Archibald Dick, Inspector of Mines for British Columbia, of receiving pay from the Crow's Nest Pass Coal Company, during the trial of the damage suits at Nelson, arising out of the Fernie explosion, is to be investigated by the Provincial Government. Mr. Dick has been suspended pending the investigation, and Mr. Frank Shepard has been appointed temporary inspector.

As lending credence to the stories which have been afloat for some time regarding the amalgamation of Le Roi, Centre Star, War Eagle and Snowshoe properties, comes the report that Mr. E. B. Kirby and Mr. Carl R. Davis have also been at Phoenix to examine the Snowshoe. Prof. W. R. Brock, of Kingston, Ont., and Mr. J. W. Astley, of the Le Roi, have been some time at the Showshoe, as per the Review's announcement last month.

The Switzer-Robinson Corporation, of Atlin, B.C., have given a bond on 18,000 out of their 20,000 acres to the Guggenheims of New York; price is not made public. The Switzer-Robinson Corporation claim to have expended between $500.000 and $750,000 in lands and machinery; they have now two dredges operated by electricity on their claims on Pine and Spruce Creeks. The claim is made that the gravel runs as high as $2.00 per cubic yard.

The Juno property on Morning Mountain, near Nelson, B. C., is to have a new stamp mill and a cyanide plant for the tailings. The main vein has an average width of eighteen inches, has been proved horizontally for 250 feet, and in depth to 600 feet. Values are not made public, but the statement is made that the ore has paid all the expenses attending 2,000 feet of development, and has $20,000 on hand to meet the cost of the mill and cyanide plant.

The Windermere section of East Kootenay is having something of a boom, due to the impression of that region of British Columbia that a railway from the Crow's Nest Pass branch line to the main line near Golden will very soon be built. The charter for the road is held in the name of the Kootenay Valley Central Co., and it is understood that the delay in the construction is chiefly due to the company not receiving the bonus which was promised by the Provincial Government.

The October shipments of lead ore to the B. C. smelters were as follows:—

	Lbs. ore.	Lbs. lead contained.
To Nelson	2,578,375	1,221,501
To Trail	4,317,599	1,391,382
	6,895,974	2,612,883

a record of nearly 3,500 tons.

Shares of the Granby Consolidated Mining and Smelting Company have been very active on the Boston Exchange since the control passed to New York parties. The present distribution of shares is said to be as follows:—

The Nichols Chemical Company and associates	400,000
American Metal Company (Phelps, Dodge & Co.).....	100,000
J. J. Hill and Great Northern Railway.....	200,000
Canadian shareholders	350,000
Miscellaneous in the United States.....	285,000
Total	1,335,000

No successor to Mr. H. S. C. Miner has been elected.

The B. C. Standard Mining Co., Ltd., owning and operating the Double Standard and Hunter V. mines, are now shipping 160 tons a day to the Granby, Northport, Trail and Nelson smelters. The bulk of this output maintains the previous high standard of 45 per cent. Ca. O. with 12 per cent. of $Si\ O_2$. A portion of the ore body recently opened is more silicious, carrying from 25 to 35 per cent. of silica, but also running much higher in metal values, viz., from $8 to $10 per ton. The crushing plant which is under consideration will save much hand labor in bull-dozing and hammer-breaking. The larger quarry is 140 feet wide with ore on all sides; the smaller one, 1,400 feet distant, is opened by a pit about 70 x 100 feet.

The right of a placer miner to stake a claim above a quartz mine has been confirmed by the recent decision of the full court, consisting of their Lordships Chief Justice Hunter and Justices Duff and Morrison, who dismissed the appeal of the Northern Mining Company, for a reversal of the judgment of Mr. Justice Martin on the same subject several months ago. In summary, the case showed that a placer miner named Tanghe had staked a claim above the Lucky Jack mine, operated by the defendant company, but had abandoned it to move aside, that he might not interefere with the quartz miners, but as the ground proved very rich, he moved afterwards to re-possess himself of the claim, and the court confirmed his right to do so.

The Centre Star Mining Company has entered an action for damages against the Rossland-Kootenay Mining Company, owning the Nickel-Plate mine at Rossland. There are several counts to the suit; one is for trespass and mining of ore belonging to plaintiffs, which fact is not disputed by defendants, but the answer is made that such trespass was the act of a predecessor in the title of the present defendants, and that present owners are not liable. At a former trial decision was for defendants, and in the appeal the plaintiffs ask not only for damages for trespass and refund of value of ore taken, but also for an injunction to restrain the owners of the Nickel-Plate from filling the Centre Star workings with water. The Nickel-Plate has been shut down for some time, and the water from that mine flows through the trespass workings into the Centre Star mine.

On the 18th of November an explosion occurred at the Carbonado mines near Morrisey in the Crow's Nest Pass region which killed fourteen miners. The explosion was of coal gas, and the place was in No. 1 mine, which is ten miles west of Fernie. The only man in the mine who escaped was D. D'Arcy, a mule driver, who was on the way out when the explosion occurred. Last year a similar explosion occurred at this colliery which killed four men, and about a year ago there was a break out of gas on the upper tunnel which shattered the roof and filled the tunnel with debris for 350 feet, but no lives were lost. This last explosion is the third in this particular mine in one year.

The Crow's Nest Pass Coal Company has been unfortunate in its experiences in No. 1 mine; they have endeavored to counteract the dangers encountered from the large amount of gas occurring in this section, and have driven a second tunnel for safety; it is now expected that the No. 1 Morrisey mine will be abandoned. At Coal Creek the company are operating successfully six mines, at Michel eight mines, and at Morrisey six; the capacity of these twenty openings is in excess of 3,500 tons a day, and some 1,200 tons of coke are made daily for the smelting industries of western British Columbia.

NORTH-WEST TERRITORIES.

The West Canadian Collieries Company are making preparations to increase the output from the Bellevue mines. Yards and sidetracks have been made which will enable the company to handle at least 600 tons of coal a day.

The Imperial Coke and Coal Company have been opening up their coal areas on the Fording River; should the C. P. R. build a branch to its own collieries in this vicinity, the company may be expected to put in its own spur and thus have connection with the outside world.

The Canadian-American Coal Co., operating at Frank, Alberta, have installed a 400 horse power hoisting engine, and are erecting a new gallows-frame and tipple. As soon as these are finished all shipments will be made from the shaft instead of the tunnel, as the shaft will serve all three of the seams now being worked. The present daily output averages 700 tons, all of which goes to the C.P.R.

THE YUKON.

From the 1st of December, 1903, until the 21st of October, 1904, the Town of Dawson lost 2,400 in population, according to the Yukon World. The bulk of these people went to the new diggings at Tanana.

Ordinary sluicing ceased on the Klondyke about the 10th of October this year, having opened early in May; this year's season therefore has been the longest known on the Klondyke since its discovery.

Sulphur Creek reports greater activity in October than in September, and a very encouraging outlook for the winter. The large companies have let out a large number of lays, and a big spring clean-up is anticipated.

The Post Office Department have made arrangements with the North-West Mounted Police by which the latter will carry mail this winter to outlying points: for this service policemen will receive additional remuneration.

The season on Clear Creek has been wet, but has not diminished the amount of work done. Provisions will be very scarce throughout this district this winter on account of failure of supplies to reach the upper portion of the left fork.

The recent discovery on Bounty Creek, a tributary of Rosebud Creek which flows into the Stewart River, is believed to be a continuation of the famous White Channel: the wash, the character of the gold, bedrock, etc., all resemble the same features of the White Channel on Bonanza.

Mr. J. B. Tyrrell, formerly of the Dominion Geological Survey, but for the last two or three years practicing as engineer in the Yukon, has brought suit against the Bronson and Ray mining concession for the sum of $30,000, alleging that this sum is due for services rendered and moneys invested in the concession; Mr. Tyrrell is himself a shareholder in the Bronson-Ray Concession.

The dredge at work on Bonanza, and the steam shovel operating at the mouth of Bear Creek, both report very satisfactory results for the season. The dredge has worked without interruption from May 5th to October 22nd, making a season of 170 days. Reports from the steam shovel plant are equally satisfactory, the only trouble experienced being the large amount of water seeping into the cut from the river.

Owners of big pumping plants, pumping water from the creek bottoms to high benches, declare the bulk of the profits are eaten up in creating steam for the pumps, and the general tone of the operators is distinctly more favorable towards legislation along the lines of the much-abused Treadgold Concession. A Government-installed and controlled water supply is now desired by property owners. Results from the Asklin ditch (running up to Twelve-Mile River) will be eagerly looked for next season.

The Gold Commissioner has rendered judgment, in the case against A. B. Palmer et al., by T. Lamar and others to deny the application of Palmer et al. for one hundred inches of water from Ora Grande Gulch, The Commissioner ordered that the flume carrying water from Eldorado Creek for Palmer et al. should be carried across Ora Grande Gulch so as not to obstruct the natural flow of the creek, and enjoined Palmer et al. from taking and using the water of Ora Grande Gulch when Lamar et al. were using it.

The Coal Creek Coal Company has employed a force of sixty men all summer at its mines, and the output will aggregate more than 6,000 tons. Of this tonnage the Dawson Electric Light and Power Co. have taken over 3,000 tons, and the balance has found a ready sale in the town. Some $50,000 have been expended at the mines on permanent improvements, among which are new loading docks and new storage bins; the mines are twelve miles distant up the creek, but the coal is brought to the docks by a dummy locomotive. The roadway of the railway has been re-ballasted, and new bridges and culverts put in.

There are some 200,000 tons of coal blocked out from the inclined shaft, but the management proposes to sink a vertical shaft during the winter, in order to cut a seam lying 200 feet below the one now opened. Some 700 to 800 tons of coal from the lower seam have been mined and tested, and have proved to be of a harder and better character than coal from the upper seam. The lower seam has a thickness of eighteen feet.

FOREIGN MINING NOTES.

Cape Colony has a mining shaft sunk to a depth of 5,500 feet, thus rivalling the deep shafts of the Michigan copper mines. The deepest borehole has been made in Silesia, and has reached to a depth of over one mile.

The Billet, Bar, Rail, Structural, Plate and Wire Associations of the United States met in New York on Tuesday, the 15th of November, to revise the whole list of prices in view of the changed conditions which have arisen in the trade.

The first two weeks of November witnessed the heaviest buying of iron and steel goods ever recorded in Chicago. Orders for over 200,000 tons were placed in that city in that time, and delivery is to be made during the first six months of 1905. In consequence of the increased activity in the United States, pig iron has advanced $3.50 per ton since October 1st.

A western contemporary is the authority for a statement to the effect that properties of the Montana Ore Purchasing Co. and F. August Heinze are under option at the price of $15,000,000 to John W. Gates and August Belmont, who, it is surmised, will turn them over to the Amalgamated Copper Company. The option is said to run until January, 1905.

The 7th ordinary general meeting of the White Pass and Yukon Railway Co., Ltd., was held in London on the 31st of October. The chairman again called the attention of the shareholders to the fact that they were really listening to a report of the proceedings of a year really prior to the year in which the meeting was held; the reason for this was that, the corporation, in effect, was really a security company, holding the securities of the local companies, and as such situated in a different country, it was somewhat difficult at the expiration of the year to get together the accounts of each company.

The issue of 1,000,000 new £1 shares by the British South Africa Chartered Co., was concluded the first of the month. Applications for three and one-half times the issue were received, and allotments had to be cut down accordingly.

The directors of the company, it will be remembered, at first proposed to float one-half of the issue to stockholders of record, having rights, and to dispose of the other half to a syndicate composed of their own friends, but this arrangement was emphatically voted down at a shareholders' meeting, and the directors compelled to offer the whole issue to the shareholders of record.

The year 1903, although exceptional by reason of the lowest water ever experienced on the Yukon River, yet the results that had been achieved were profitable, the net profit for the year 1901 had been £137,000 sterling; for 1902, £60,000 sterling; for 1903, £58,000 sterling. The payment of a four per cent dividend was recommended and adopted, being one per cent. less than last year. The freight business has increased from the previous year by some twenty per cent., and in the river division the passenger business had increased twenty-five per cent.; the freight business had increased about ten per cent., but the operating expense had been decreased, and results were gratifying. Mr. H. S. Graves, the president of the local companies, addressed the meeting on the prospects of the company for the current year. Mr. Graves gave it as his opinion that more progress had been made in 1904 than in any previous year in extending actual mining operations in the Yukon country. The Klondyke continued to be the chief camp, but it was no longer the only large one. The volume of tonnage continues to increase, and there is no foundation whatever for the pessimistic rumors heard from time to time in the public press.

COAL NOTES.

The Dominion Coal Company's contracts for St. Lawrence River ports aggregated 1,227,000 tons for the season of 1904.

Shipments from the Springhill Coiiieries for the month of October by the Cumberland Coal & Raiiway Company amounted to 36,896 tons.

The consignment of coal from Nova Scotia, which is to be tested as to its suitabiiity for naval purposes, arrived at Portsmouth Dockyard on November 22nd.

Shipments of coai from the United States to the port of Montreal have not been large this season, the total aggregating about 265,000 tons, of which only 40,000 tons came via the inland waterways.

The heaviest shipments of this season from Nova Scotia to the port of Montreal were in the month of June, when 277,239 net tons were delivered; the next heaviest were in the month of July, which totalled 252,677 tons.

The approximate tonnage of coal which has been sent to Montreal this season from Nova Scotia is 1,500,000 tons. Up to the 11th of November there had been delivered 1,352,863 tons of bituminous coai, and there were then three further weeks of deliveries due.

The Cape Breton Coai, Iron and Raiiway Co. heid a meeting on the 17th inst., at which the bonds of the company were transferred from the Guardian Trust Company of New York to the Royal Trust Company of Montreal; the business of the company will hereafter be done in Canada instead of the United States.

The Maritime Coal and Railway Company, operating at Chignecto, N. S., is now putting out about 200 tons of coal a day, furnishing employment for 150 to 160 men; and it expects to doubie this amount shortly. The company's charter permits the construction of a railway from the mines to a point in the Straits of Northumberland.

Reports from Michei, B. C., are to the effect that building has been brisk during the summer, but that otherwise business has been duii, owing to the fact that for over three months now the mines have only been worked for four shifts during the week. Lately, the local depression has been increased by the posting of notices to the effect that No 3 mine wouid ciose down, and oniy married men be employed. Recentiy notices have been given that Nos. 4 and 5 mines wouid aiso shortly be closed. The superintendent, Mr. A. R. Wilson, says that the output wiii be about as usual this winter, but that fewer men wiii be needed, and they will have steady empioyment and fuii time.

The shipments from the Dominion Coal Co.'s collieries for the month of October aggregated 294,615 tons.

The output during this same month amounted to 294,038 tons, made up as follows:—

Dominion	No.	1	50,671 tons.
"	"	2	66,209 "
"	"	3	29,418 "
"	"	4	41,260 "
"	"	5	67,628 "
"	"	7	15,903 "
"	"	8	22,949 "

The International Coai and Coke Company, at Coleman, Alberta, have made a record performance in the rapidity with which they have pushed development and equipment. Within fifteen months, one and three-quarters miles of galieries have been driven on the coal seams of the company's property; and its capacity is now estimated at 1,000 tons in every twenty-four hours. The siope has now reached a depth of 150 feet, and fifty rooms are now ready to break coal. A reversible doubie Capeii fan, capable of delivering 150,000 cubic feet of air, has been instaiied, with a 150 horse-power motor to drive it. The haulage system of the mine is of the compressed air type, the air being furnished by a four stage compressor, which delivers air at the pressure of 1,000 pounds to the square inch. The power-house contains four boilers, with a totai capacity of 600 horse-power, two electric generators of 325 horse-power each, and the four stage air compressor. In addition to the mining piant, a very complete machine shop has been fitted up, which is aiso driven by electricity.

NEW COMPANIES.

BRITISH COLUMBIA.

The Eagie Mining & Development Co., Ltd. Incorporated Oct. 21st, 1904. Capital $100,000.

"The Gold King, Ltd." Non-personal liabiiity. Incorporated Oct. 21st, 1904. Capital $120,000.

The Canadian Metal Company, Ltd. Non-personal liability. Incorporated Oct. 20th, 1904. Capital $1,100,000.

The Bayonne Gold Mines, Ltd., registered on Oct. 13th, 1904, as an Extra Provincial Company. Capital $450,000.

Piikington Brothers, Limited, head office, St. Helens, England, Capital £800,000, has been registered on Nov. 8th as an Extra Provincial Company, with Arthur G. Thynne, of Vancouver, B. C., as attorney, with head office in Vancouver, for the Province.

The Velvet Portland Mine, Limited, head office, Engiand, Capital £125,000, has been registered as an Extra Provincial Company on Nov. 7th, 1904, with Charles R. Hamiiton, of Victoria, as attorney for the company, and head office for the Province at Rossiand.

ONTARIO.

The Dominion Natural Gas Company. Head office, Hamilton, Ont. Capital $500,000. Provisionai Directors:—Wiiliam Aikens, Henry Cockshutt, Edmund Cockshutt, Joshua Hamiiton, and Edmund Sweet, aii of Hamiiton. Incorporated Oct. 12th.

The Aigoma Power Co. Head office, Berlin, Ont. Capitai $100,000. Provisional Directors:—Daniei Detweiler, Oiiver Kinzie, Noah Detweiier, and Charies Hagedorn, all of Berlin.

The Windsor Gas Company. Head office, Windsor, Ont. Capital $200,000. Provisional Directors:—S. A. King, with Wm. C. Kennedy, of Windsor, Ont.; and J. C. Baxter, of Detroit, Mich. Incorporated Oct. 24th.

The Camp Bay Gold Mining Company of Ontario, Ltd., of Arizona, has been granted a licence, dated Oct. 26th, to operae in Ontario under the name of the Arizona Camp Bay Gold Mining Company of Ontario. Charles Brent of Rat Portage, Ont., is to be the company's attorney.

Digest of Recent Patents; Mining and Metallurgical.

CANADIAN.

Oct. 25, 1904.

773,450.—Process of Making Aiioys. Robert S. Anderson, Seattle, Wash., assignor of three-fourths to Waiter F. Horner, Wiiiis C. Meeker, and Hiram U. Woodin. A process which consists in mixing copper and tin, and heating the same untii they are brought into a molten mass, and then adding suiphate and finaiiy adding aluminium.

773,194.—Apparatus for transferring coal or other material. Jeremiah Campbeii, Newton, Mass. An apparatus for transferring coal or other material, devices as a truck and a carrier-tower or support mounted upon the truck, upon which they are horizontaiiy movabie, and a bridge or extension carried by said means and affording a device by which the truck and carrier-tower or support may be moved horizontaiiy from said means, in combination with means located beyond the farther side of the bridge from said level-varying truck-support whereby said tower may be supported whiie in action.

773,246.—Magnetic Separator. John W. Carnoghan, Silvercreek, N. Y., assignor of one-haif to Aibert B. Chapman, Silvercreek, N. Y. The combination with a downwardiy-tapering miii-hopper, of a magnetic separator comprising a downwardiy-tapering funnel, which is seated loosely in the miil-hopper, and separating-magnets supported on the funnel at the outlet thereof.

773,266.—Amaigamating Machine. Gerard C. Scott, Columbus, Ohio. The combination of a substantiaiiy horizontal tapered mercury-containing casing closed at its iarger end and open at its smaller end with an iniet for its larger end, a steam-jacket for the lower portion of the casing, a longitudinal substantiaiiy horizontal shaft journaled within the casing and a closed amalgamating-body carried axiaiiy upon the shaft, tapered with the casing and provided with longitudinal substantiaiiy radial blades, means for rotating said amalgamating-body and an inciined taiiings-discharge chute located adjacent to the smaiier end of said tapered amaigamating-body forming a continuation of the tapered casing.

773,210.—Conveyor. William C. Mackellar and Thomson Mackenzie, Greenock, Scotland. In combination with a body for supporting the material, inclines upon which the body is supported and means for reciprocating the body longitudinally over the said inclines, said inclines being rigid and sloping toward opposite ends of the body.

772,925.—Roasting and Smelting Furnace. Harvey Cockell and William H. Fish, Columbus, Ohio. An ore roasting and smelting apparatus, a furnace, an outlet for the products of combustion therefrom, an ore feeding and roasting chamber located in said outlet having a separate discharge into said furnace, and a fuel-supply communicating with said discharge.

Nov. 1, 1904.

773,732.—Stamp-Mill. Alvan P. Granger, Denver, Colo. The combination with a stamp, of a swinging arm provided with bearings through which the stem of the stamp passes, one of the bearings engaging a stop on the stamp, whereby, as the arm is lifted, the stamp is raised, and means acting on the arm between the stamp and the axis of the arm to lift the stamp.

773,809.—Coke-Oven. George S. Ramsay, St. Mary's, Pa. A coke-oven having a stack, and provided with a main bottom flue communicating at one end with the stack, front and rear upstanding flues communicating at their upper ends with the interior of the oven, and the independent front and rear bottom flues connecting the upstanding flues with the main flue, and the flues on each side of the main bottom flue being independent of the flues on the opposite side and also independent of each other.

773,636.—Process of Recovering Nickel Oxide and Ammonia. Hans A. Frasch, New York, N.Y. The method of recovering nickel oxide and ammonia from nickel ammonium chloride, consisting in subjecting the nickel ammonium chloride to distillation in presence of a dehydrating agent, thereby expelling ammonia and precipitating nickel oxide, removing the distilling fluid from the nickel oxide, treating it with calcium oxide, and subjecting it again to distillation.

774,092.—Manufacture of Carbonic Acid. James Leslie, Belfast, Ireland. The process of manufacturing carbonic acid, which consists in burning carbon free of hydrogen in a confined space, cooling the resulting gases first by utilizing their heat to drive off the carbonic acid from a bicarbonate solution, then washing them in cold water, then driving them under strong pressure into intimate contact with an alkali monocarbonate solution, from above which and while still under pressure, the extraneous gases are allowed to escape, and which solution is afterward heated under reduced pressure and the carbonic acid driven off, condensed and stored or utilized.

774,083.—Apparatus for making Sulphuric Anhydrid. Rudolph Knietsch. Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany, a Corporation of Baden. In combination, a contact-compartment enclosure, a plurality of substantially horizontal layers of contact material adapted for the formation of sulphuric anhydrid by catalytic action arranged in a substantially vertical series and each extending substantially across said contact-compartment, gas-passages connected with said compartment respectively above and below said plurity of layers, a series of pervious supports detached from the walls of said compartment and a connecting member extending through said series of supports.

Nov. 8, 1904.

774,476.—Conveyor. David E. Hughes, San Diego, Cal . Means to elevate objects, without canting them, from a lower to an upper table comprising a frame having journaled therein an upper and a lower shaft; chain-carrying wheels keyed thereon two endless chains carried by said wheels, cross supporting-beams journaled in said chains and having downwardly-projecting offsets; load-carrying cross-arms mounted above and on the supporting cross-beams; the cross-arm spaced apart and above the beams sufficiently far to pass above and on either side of the projecting ends of the upper table, and the supporting-beams below the projecting ends.

774,304.—Metallurgical Process. Martin P. Boss, San Francisco, Cal. A method of producing steel direct from iron ore, which consists in subjecting the ore to the reducing action of a hydro-carbon-flame, and at the same time to the combining action of a hydro-carbon vapor.

774,591.—Furnace for Reducing and Smelting Nickel Oxides. Robert R. Maffett, Bayonne, N. J., assignor to International Nickel Company, a Corporation of New Jersey. A furnace having an open-hearth smelting-chamber, an elongated reducing-chamber leading therefrom, charging-openings for said reducing-chamber arranged lengthwise thereof, a flue extending beneath the reducing chamber, and a stack-flue with which the reducing-chamber and flue communicate at their rear ends.

774,614.—Dumping-Car. Swan F. Swanson, Pueblo, Colo. The combination of a body-frame having a central bottom ridge, swinging bottom gates hinged upon each side of said ridge, a series of toggle-levers connecting said body-frame and said gates upon each side of said ridge, a shaft journaled beneath said bottom ridge, crank-disks upon said shaft, oppositely-disposed adjustable links connecting said crank-disks and said toggle-levers, and threaded blocks, for adjusting said links to vary the movement of said toggle-levers.

774,704.—Ore-Washing Machine. Gustave Seberg, Racine, Wis. An ore-washing machine, a main receptacle, a sluiceway surrounding said receptacle, the floor and outer wall thereof being formed integral with said receptacle, said floor-section being slightly inclined toward said main receptacle, an inner wall and means to adjustably secure said inner wall above said floor-section.

774,387.—Hoisting Apparatus for Blast Furnaces. Harry Heffrin, Pittsburg, Pa., assignor to Thomas H. Martin, trustee, Pittsburg, Pa. A hoisting mechanism for blast furnaces having in combination a skipway, a constant-speed motor, a car movable along the skipway, and means for moving said car operated by said motor, and having a slower speed as the car approaches the ends of its travel than between intermediate points.

Nov. 15, 1904.

775,241.—Artificial Fuel. George K. Hollister, Jr., New York, N. Y. An artificial fuel briquet composed of carbon particles, water, clay, resin, muriatic acid, molasses, sulphate of iron and alum, and bakes until hard and dry.

775,043.—Process of Recovering Gold and Oxide of Iron from Sand. Thomas J. Lovett, Chicago, Ill. The process of obtaining the values from concentrated gold-bearing iron oxide in a finely-divided condition, which consists in subjecting the iron oxide to the lixiviating action of a suitable chemical solution capable of dissolving the gold without materially injuring the iron, separating the iron and solution, then recovering the gold from the solution.

774,731.—Portable Conveyor. Jesse Ainsworth, Lyons, Kans. The combination of a truck-frame mounted on wheels, a conveyor-frame mounted on said truck-frame, and projecting outward therefrom, a conveyor-belt and supporting-rollers on said conveyor-frame, the outer end of said conveyor-frame being divided and hinged transversely to adapt said outer section to fold over upon the main section, a suspending device connected to the conveyor-frame inside of said hinged section, and means on the truck-frame for driving the conveyor.

774,786.—Gold-Saving Apparatus. Louis Sachse, Oroville, Cal. The combination with a tank having upper and lower compartments arranged one above the other and having a floor between them, said compartments intercommunicating through an opening in said floor, means restricting the outflow from the upper compartments; means vertically over the opening adapted and arranged to intercept the precipitates from such liquid through the opening into the lower compartment, and means for supplying a current of water above said opening in said floor.

774,930.—Process of Reducing Ores. Horace F. Brown, Oakland, Cal. The process, which consists in first passing the ore in a finely crushed or pulverized condition through a non-whirling atmosphere, and then subjecting the highly-heated ore to the action of a whirling heated atmosphere moving in the same direction as the travel of the falling body of ore.

775,060.—Process of Reducing Aluminum or other Metals. Henry S. Blackmore, Mount Vernon, N. Y. A process which consists in fusing a metal oxy-compound, adding an oxy-compound of a metal having less affinity for oxygen, subjecting the mass to the action of an electric current capable of liberating the metal having less affinity for oxygen, and replenishing the mass with an oxy-compound of the metal liberated and separated as the fused bath is depleted thereof by reduction.

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills, who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licences to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly, either by arrangement with the owner or by arbitration, all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

PROVINCE OF QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles and the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mining of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals, and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in surveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds: Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P.Q.

Dominion of Canada.

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location.

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital.

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within 15 days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid, the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permisson may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location.

PLACER MINING

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee $5, renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental $100 per mile for first year and $10 per mile for each subsequent year. Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be made within ten days, if the claim is within ten miles of mining recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10. Royalty at the rate of two and one-half per cent. on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller.

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2. A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200.

A certificate that work has been done must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner.

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM.

All unappropriated Dominion Lands in Manitoba, the North-west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior

OTTAWA, February, 1904

JAMES A. SMART,

Deputy of the Minister of the Interior.

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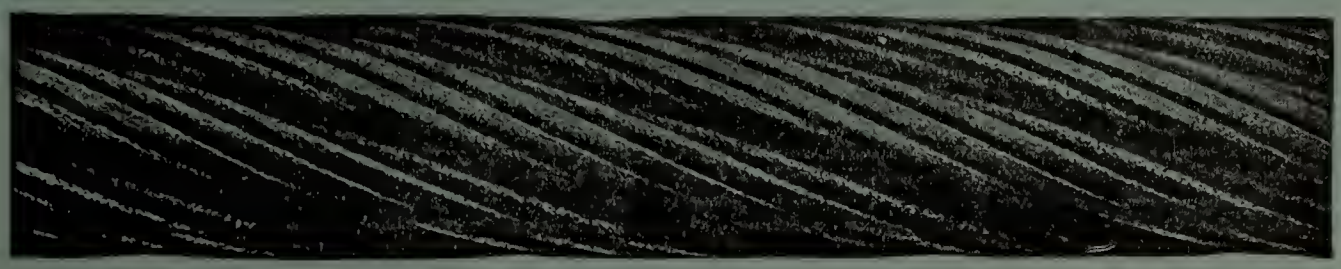

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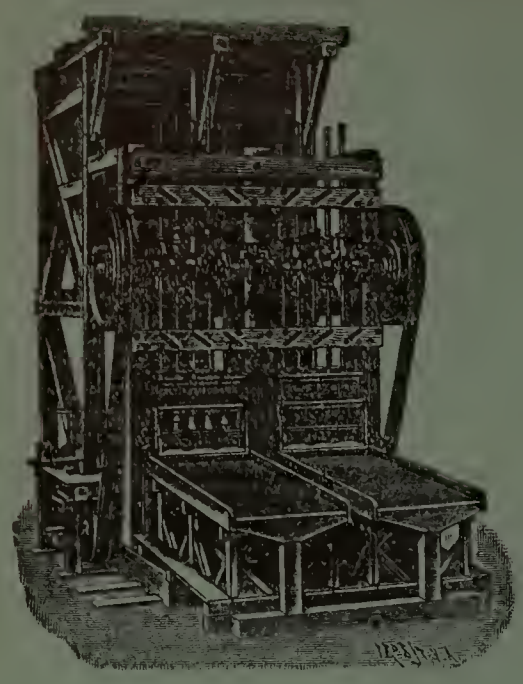

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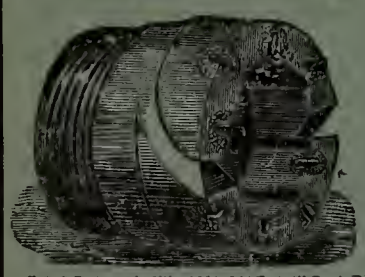

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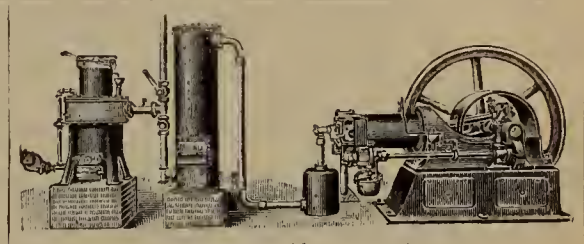

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CONTENTS.

A despatch from the Canadian Associated Press in London, reports a returned member of the Iron and Steel Institute to have expressed himself regarding the Lake Superior Corporation as follows :—"It is a concern which has leaned on the politician and has had more direct and indirect help from him than any industrial enterprise that was ever put on foot anywhere in the Anglo-Saxon world." Vulgarly but truly—Them's our sentiments.

The same Englishman remarks that even in the days of free trade with Canada, no English rail mill could have successfully competed with the Edgar Thompson rail mills in the manufacture of the rails which he saw making for the specifications of the Canadian Pacific Railway. He says "It would need an export bounty from the British Government and an import bounty from the Canadian Government to make trade follow the flag" in such a case.

The New York "Evening Post" has some caustic comment in its paragraphs on Montreal and Boston consolidated stock. Referring to the market on December 8th when the stock tumbled from 3⅝ to ½, it says that the collapse excited a great deal of interest "because of the notorious advertising this stock has had. There had been flaring advertisements, sometimes amounting to more than half a page a day, with alleged guarantees in some of them that those buying at a certain price would have the privilege, at any time within thirty days of returning their shares to certain brokers at a price slightly below the figure paid. On some days more than 50,000 shares were reported dealt in, and in a single week the total ran above 200,000 shares—very heavy operations for a curb stock. The collapse to ½ or 50 cents (par value $5.00), really amounted to a drop from 72½ per cent. to 10 per cent. of the par value, all within 48 hours." If the "Post" desires fuller information about this stock we fancy several Montreal people can give it; if not, then, there are many British Columbians who can supply it without charge.

A despatch from Rossland, under date of Dec. 10th, reports that the mill of the Rossland Power Company has closed down temporarily. It will be remembered that this company is a subsidiary corporation, owned and controlled by the Centre Star and War Eagle mining companies, organized to deal with the concentration by water of the pyrrhotite ores of the Rossland district. The process used depended upon the feasibility of concentration of coarse (¼ inch) particles of the ore by jigging, and of extraction of the gold values from the fines which passed a one-quarter inch mesh by a cyanide treatment. Results have shown that, the coarse particles do not concentrate satisfactorily by water, the grade remaining low as before concentration; and that the finer particles (which remained with the tails) were of too high a value in gold, from $100 to $200 per ton, to give a satisfactory extraction by cyaniding. It is proposed, we are informed, to attempt a recovery of the high values by tables and also to experiment as to the possible recovery of gold values that may be made by fine grinding and amalgamation. The non-success of the plant and the consequent delay and further experimentation are much to be regretted.

The Seventh Annual meeting of the Canadian Mining Institute will be held at the Windsor Hotel in Montreal on the 1st, 2nd and 3rd days of March, 1905. An interesting syllabus of papers is being arranged for, covering practice and progress in mining from Nova Scotia to British Columbia. The business to be transacted is also important, and a full meeting is anticipated.

Canadian Coal and the Coal Duty.

The large increase in the production of coal in Nova Scotia and Cape Breton, and the search for profitable markets which the Dominion Coal Co. has been (and is yet) making, has again aroused in some quarters the question of coal duties, and discussion of the possibility of extending the domestic market to include Ontario.

Probably the passage of resolutions by some local boards of trade to the effect that the duty on American soft coal should be taken off has been the inciting cause of the discussion referred to. The contention is made that geography, and hence freight rates, determines Montreal to be the extreme western market for Nova Scotia coal, whereas from Montreal westward to Winnipeg geographical conditions point to a southern source of supply—which means Pennsylvania, West Virginia and perhaps Ohio.

It is known in Montreal that Dominion coal influence has been exerted towards the deepening and widening of the canals so as to permit coal boats to reach Toronto, without having to barge their cargoes; it is also known that the energetic president of that corporation is by no means willing to have the Cape Breton mines go into a state of hibernation, as previously they have done, every winter. In fact, the shipments of coal to Mexico and South Africa are experiments in the line of finding profitable winter markets.

But although various and repeated attempts have been made to find European and foreign markets for Cape Breton coal, the results have never been successful, or, at any rate, only moderately successful. The nearest and best foreign market is Boston, but the quality of the Cape Breton coals is not good enough to compete with the coal from Pocahontas and other West Virginian mines, it is too friable to stand much handling and it gives too dense a smoke to be acceptable in that market as a fuel. Moreover, the cost of cutting Cape Breton coals and putting them on board is in excess of similar costs in West Virginia. That these costs are higher *necessarily* is not admitted by many competent managers, but that they are so under existing conditions is a fact.

Freights to Boston from Sydney are lower than from Montreal to Sydney; rates to Boston are 60 cents per ton, and have been lower, while the rate to Montreal was 90 cents, and has been much higher. Moreover, the New England market, if it could be obtained, would take three or four times the tonnage which Ontario is likely to take.

When the coal duty was imposed at the time the great so-called "National Policy" was proclaimed (1879), the output of the Nova Scotian coal mines was in the neighbourhood of 700,000 tons, to-day the output is seven times that amount. There seems, therefore, to be sound argument available on the part of those gentlemen who are seeking for abrogation of the coal duties. That the United States will follow suit and permit Canadian bituminous coal to enter free of duty does not at first seem so certain, but it must not be forgotten that the northwestern states, Montana, Washington and Oregon, together with California, would gladly welcome the chance to get our British Columbia coals free of duty. Conditions as to coal have changed enormously in the West in the last ten years; the opening of the mines in the Crow's Nest region, in both Alberta and B. C., and the building of branch lines by both the Great Northern Railway and the C. P. R. have provided the Pacific slope with a fuel it has never had before as to quality. So, that the coal duty problem is no longer an eastern question for Nova Scotia and Massachusetts to settle, it is a national problem on which British Columbia and the northwestern states will insist on being heard, and their views will certainly be of value and, in all probability, will incline to the abolition of the duty.

Mexico, for Mining Engineers and Investors.

The old country of the Spaniards, the Republic of Mexico, has been attracting a good deal of capital and a not inconsiderable number of professional mining men during the last two or three years. Thanks to Porfirio Diaz, President of the Republic, Mexico now has a stable government and security for property and life throughout the greater portion of its domain. It has, in addition, a climate which is both most agreeable and healthful, and in most of the mineral regions the temperature has no such extremes as one would imagine from the tropical situation of the country. So far as outdoor operations are concerned the climate is more favorable than that of either Australia or South Africa and is even better than that of California when the whole 365 days of the year are considered.

The mining engineer, however, must not be misled by the irresponsible items he reads in the current press respecting the great opportunities presented by that country for "modern methods and greater savings." The engineer who goes to Mexico with the idea that he can improve everything that he may see in the methods employed there, and who swaggers in a domineering manner over the native foreman and superintendent, and assumes a conscious air of superiority, will find himself in very bad odour with the Mexicans and will probably regret his advent into that country. The importation of American labor has shown rather conclusively that costs are increased by the use of such labor as against the employment of native miners: this is particularly true of lode mining. The few large mining and metallurgical enterprises which have been operating in Mexico during the last half dozen years have been backed by financially powerful people who have only undertaken going concerns or proved propositions, and who have worked their property on the large scale which large financial resources permit.

From information personally received it appears that Mexico offers greater inducement at the present time to the small capitalist than to the large one. The individual, if he be an engineer, who goes into that country with a modest capital at his back and who will use common sense, much courtesy and sound business principles, will have little difficulty in buying, or optioning, small properties which, by the exercise of the qualities just mentioned, will return very handsome dividends upon the investment. Like other mining countries there are large numbers of small mines which can produce handsome profits for a limited time, and permanent

propositions are, perhaps, no more abundant than in other mining countries. Many of these smaller properties that are now working by native Mexicans are passed by, without consideration, by the professional man who is looking for a *large* mine. When investigated many of these little properties are found to be working on a hand-to-mouth principle, which is occasioned by the necessities of the owner, but which reveal to the practised eye of the engineer possibilities of a greatly enlarged output if operations could be increased through the aid of a little capital. One of our correspondents tells the story of a 12-inch free gold vein, the ore from which was packed on burros nine miles or more for treatment, although a good water power was within half a mile of the property. This mine was purchased by a young American who invested $5,000.00 in a five-stamp mill which he erected within 3,000 feet of the property, and which, once it was in operation, returned to the owner a net profit of $1,500.00 a month. Our correspondent informs us that there are many sections throughout Mexico in which similar conditions exist, and in which a young, energetic and practical man with a few thousands can do as well, if not better, than in the case just cited. But for professional men to go there without capital for investment, and to depend upon the earnings of professional fees, is to court serious disappointment.

For the investor the opportunities are similar to those of the professional man—small capital can find many opportunities for profitable investment, not alone in mines but in small metallurgical enterprises such as furnaces for custom smelting of ores.

We are led to these remarks because of the increasing number of Canadian engineers who are tending towards the Mexican republic. It is the wish of the REVIEW to safeguard these men against probable disappointment and also to keep as many of them as possible in Canada where the lack of really competent mining engineers is most obvious. We cannot blame our older men for seeking a more congenial climate, nor the capitalist for desiring returns continuously for twelve months instead of having his profitable season limited to from four months in the Yukon to, say, six or seven months in Quebec or Ontario, but we clearly point out that the field for the capitalist in Mexico is rather one for small amounts than one for the investment of large sums.

An Installation of Electric Power for a Quebec Mine.

The old and important Eustis Mine at Capelton, P.Q., which has been a steady producer for over thirty years of sulphur, copper and the precious metals, has recently had important alterations made in the motive power by which its mining operations are conducted. Electricity generated by water power has been substituted for steam power, and the installation has been so arranged that in case of deficiency in, or stoppage of, the electric power a delay of only a few hours will substitute steam, so that operations under ground need not be suspended.

The ore bed of this mine, which belongs to a private corporation known as the Eustis Mining Company, is an immense pyritiferous deposit yielding on an average three per cent to four per cent. of copper and varying small amounts of silver and gold, i.e., from two ounces to six ounces of silver to the ton, and fractional parts of an ounce of gold.

The deposit has been opened by two incline shafts of which No. 1 is 2,600 feet long, and No. 2 is 2,350 feet from the surface. The mine was originally opened on the top of a hill, but some years ago a tunnel was driven, some one thousand feet, to cut the deposit at a depth of five hundred feet below the old shaft mouth. All ore extracted is now delivered through this tunnel.

The annual output of the property is from 25,000 to 30,000 tons, and about 150 persons are employed.

The electricity for the plant is generated by a water power situated on the Coaticook River, about one mile above its junction with the Massawippi. At this point a wooden dam, about fifteen feet high, has been built. At one end of this dam are placed the head-gates from which a wooden pipe, seven feet in diameter, carries the water to the power house situated 340 feet farther down the river. Just outside of the power house this wooden pipe is led into a twelve-foot stand pipe or penstock, thirty feet in height, to which is connected, directly opposite the wooden pipe, a steel tube, also seven feet in diameter, which takes the water from this stand-pipe directly to the turbine case. The stand pipe is provided with an overflow, six feet above the normal water level, designed to take care of the back rush of water when the wheel gates are suddenly closed, but in practice it has been found to be seldom necessary. The water wheels are of the Crocker pattern and were built by the Jenckes Machine Company, Ltd., of Sherbrooke, P.Q.; they consist of two pairs of eighteen inch wheels mounted on one shaft. The wheels are set in one steel case, the setting being of the type known as "central discharge," that is each pair of wheels discharges into a central draught compartment which is provided with a single draft tube or discharge pipe. The turbines were designed to furnish 450 h.p. at a speed of five hundred revolutions per minute under a head of thirty-two feet, but the plant is now running under a head of thirty-six feet. In the design of the power house provision has been made for a third pair of water wheels, and these will be placed in an extension of the present sheet steel casing; the inlet tube is large enough to supply the three pairs of wheels without making any deficiency of water for anyone of the three pairs.

The turbine shaft is directly connected to a 200 K.W. Westinghouse three phase 2,200 volt, 25 cycle, rotary field generator. The exciter has 7½ K.W. capacity and is operated at 875 revolutions per minute by a separate 9-inch Crocker turbine, which also is directly connected. The electrical controlling and connection apparatus is mounted on a single panel switchboard. The leads from the machine are brought to the board through a tile pipe laid under the floor. The power line from the switchboard is taken through the end wall of the building across the river to the mines (a distance of about two miles), and consists of three No. 1 hard drawn copper wires, spaced eighteen inches apart, in the form of a triangle on the poles.

At the receiving end of the power circuit there are three stations, one for the air compressor, one for the hoist, and one for the crushing machinery. The air compressor house is placed just outside the entrance to the mine tunnel. The compressor is of the two stage type and is a Canadian Rand Drill Company's class D-2, belt driven, cross compound machine, fitted with a Rand water tube intercooler. The cylinders are 13 inches by 18 inches and 20 inches by 18 inches, with Corliss inlet valves on the low pressure cylinder. The compressor is driven by a 100 H.P. Westinghouse, 2,000 volt, constant speed, induction motor controlled by a switchboard on which are mounted the starting switch, fuses, etc.

The hoist is situated at the inner end of an adit tunnel, 1,000 feet long, through which the power is carried by three No. 4 weather proof wires, which are further protected by being placed in a heavy wooden box bolted to the rock wall of the tunnel. This hoist, which was designed and built by the Jenckes Machine Company, Limited, of Sherbrooke, Que., is placed about twenty-five feet above the tunnel level in a chamber cut out of the solid rock. It has two cast iron drums, 72 inches diameter by 48 inches face, mounted on separate shafts which are 6 5-16 inches in diameter; both drums are driven by one motor through a double set of gears. The drums are connected to the motor by friction clutches of the Lane type, and are provided with band brakes and indicators, which show the position of the skips in the shaft at all times. The clutches and brakes were designed to be controlled by levers operated either by air, or by hand; in practice, so far, only the hand levers are used. The motor for the hoist is a Westinghouse 150 H.P. three-phase, 2,000 volt, type F, variable speed induction motor, with a normal speed of 480 revolutions a minute. The controller is mounted on the engineer's platform and has seven steps; it acts by connecting different resistances, in series, with the rotating part of the motor. These resistances are entirely separate from the machine, being connected with it by means of three slip rings.

The mine incline varies from forty-five degrees to twenty degrees as depth is obtained. At present it has a depth of over 2,000 feet, and is equipped with double tracks of four feet gauge laid with 56 pound steel rails. The skips are self dumping and are not run in balance. These skips discharge into bins, the bottoms of which are about five feet above the tunnel track, which allows the cars running on the latter to be loaded through hoppers. The nominal speed of the hoist is five hundred feet a minute, but it has been found in actual practice that it only takes from five to six minutes for the skip to come from the bottom of the mine, discharge its load, and return again to the bottom. The total load hoisted (rope, skip and ore), is from 7½ to 8 tons.

The crushing plant is situated by the side of the railroad track, about three-quarters of a mile from the mouth of the tunnel. This plant is supplied with power by a branch from the main line, and the machinery at present consists of a 20 inches by 6 inches Farrel crusher with a set of geared rolls used for reducing the hard ore to fines. This hard ore occurs in parts of the mine but not in all. The two machines (crusher and rolls), are driven by a 50-horse power, 200 volt, slow speed, type C, Westinghouse induction motor, supplied through two 25 K.W. transformers. Electrical measurements indicate that these machines take about 40 H.P. when crushing eight tons per hour. This plant is only a temporary one, to be used until the new mill, now under construction, is completed. This new mill will be driven throughout by 2,000 volt motors. It is designed to handle all the ore from the mine, and will both dress the rich ore for shipping and crush and concentrate those ores which are too lean to ship.

The hoist is so designed that, in case of accident, it may be operated by steam power by simply coupling an engine to each end of the countershaft of the new hoist, an operation which will require very little time. Steam will be supplied to the engines by old boilers, located about fifty feet away, the stacks from which consist of two tile pipes laid up the old shaft to the surface above.

The old compound steam, single stage air compressor, built by the Canadian Rand Drill Company, which is located just over the mouth of the adit tunnel, can be used in the case of low water, or, of accident to the electrically driven compressor. Steam is supplied to this old compressor by the two 125 H. P. boilers which formerly ran it.

In a recent test of the new plant it was found that, when double the full load was on the generators (a 100 per cent overload test) the level of the water in the stand pipe was below its normal point, and that the water in the tail race was above the normal point; these water levels, both above and below, fluctuated rapidly and it was difficult to gauge them accurately with the means which were on hand at the time of the test. The actual head of water on the turbines is supposed to have been thirty-three feet, and if this assumption is correct the water wheels would have used, theoretically, 706 horse power of water, of which amount about 18 H. P. was consumed in the exciting generator. Allowing the main generator to have used 688 H. P. and on the assumption that it developed one hundred amperes per phase at a voltage of 2,160, and on the further assumption that the efficiency of the generator at this overload was 92 per cent., and that the power factor of the circuit (water rheostat) was unity, the brake horse power developed would have been about 543 H. P., which would give an efficiency of 78.9 per cent. for the water wheels. As the electrical measurements were not accurately taken, and as the head of water (as already mentioned), fluctuated, the results are doubtful, but the probability is that the efficiency was less, rather than greater, than the above figures. Similar tests made with the wheels operating at partial load, and, therefore, partial gates, showed that the efficiencies at 271 and 390 E. H. P. were respectively 51 per cent. and 65 per cent. approximately. The 271 E. H. P. would represent the conditions under which the plant operates while the hoist and the compressor are in use.

As the hoisting plant is quite unusual in its use of induction motors the following consumption of a power for the various stages of the hoist is given. These figures were taken by Mr. Davis (the electrician in charge), and are readings from his electrical instruments.

The method adopted in hoisting is, on receipt of the mine

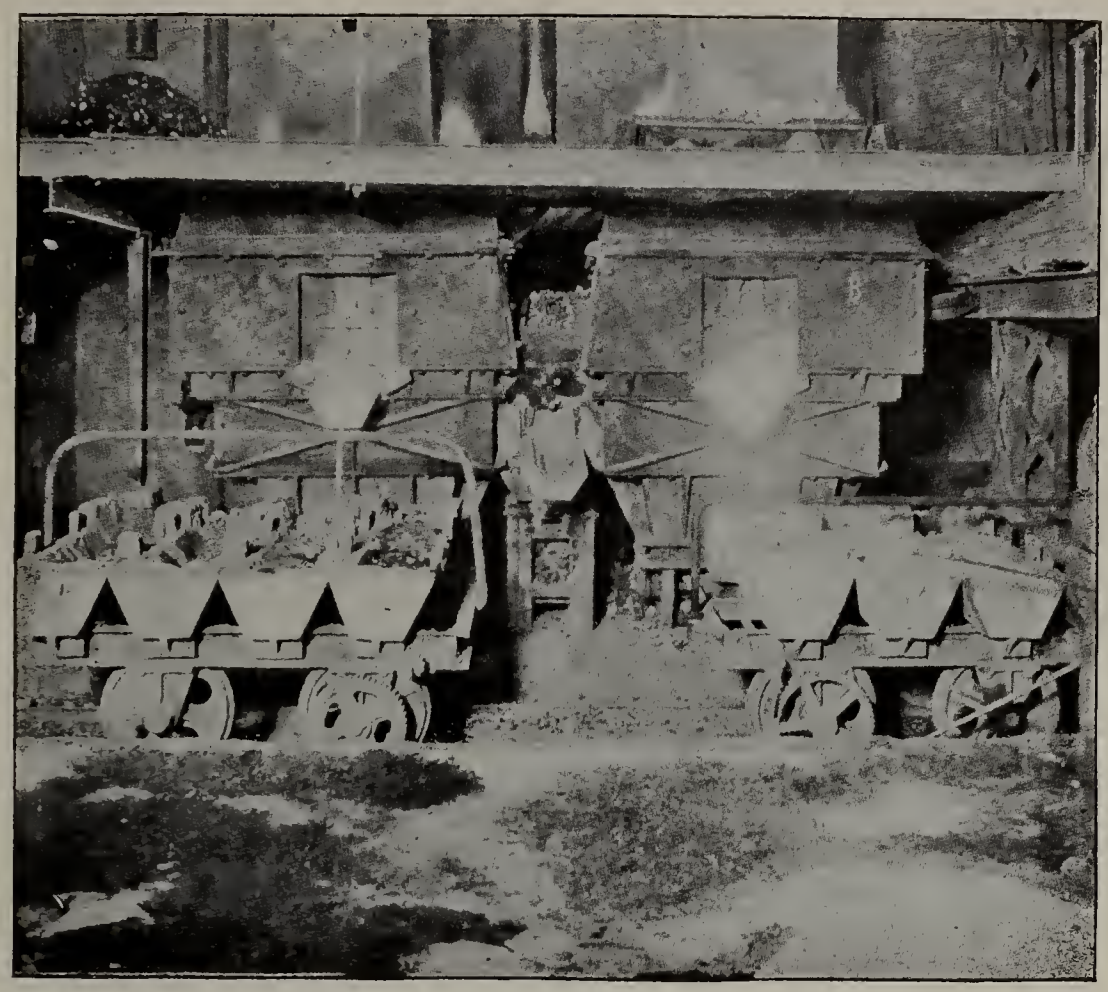
View of the Dam on Coaticook River,
Eustis Mining Co.

Side Hill Excavation for Circular Wooden Flume,
7 feet in diameter.

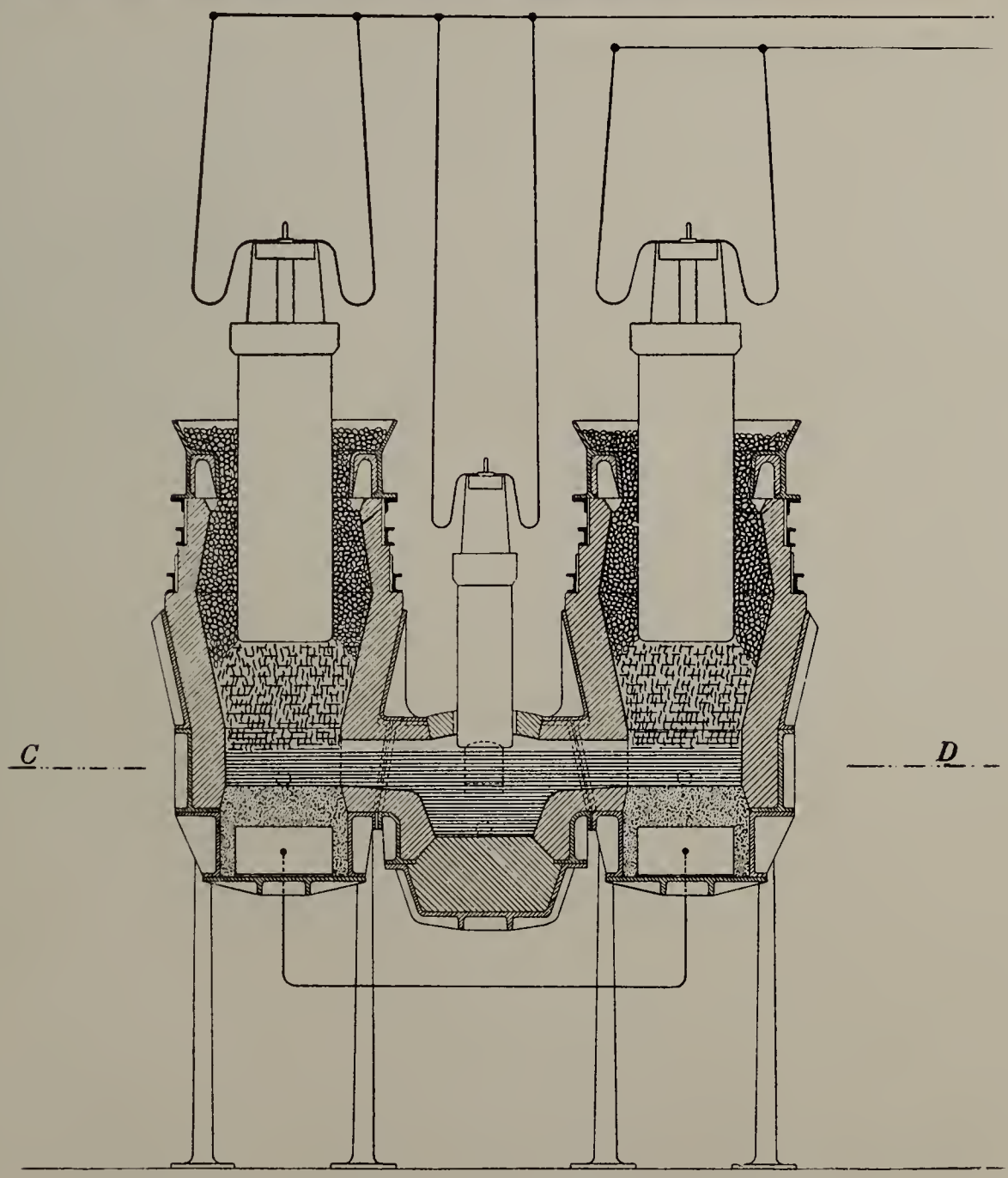
Coaticook River below the Power Dam,
showing fall of 15 feet.

General View of Kjellin Electric Furnace at Gysinge, Sweden.

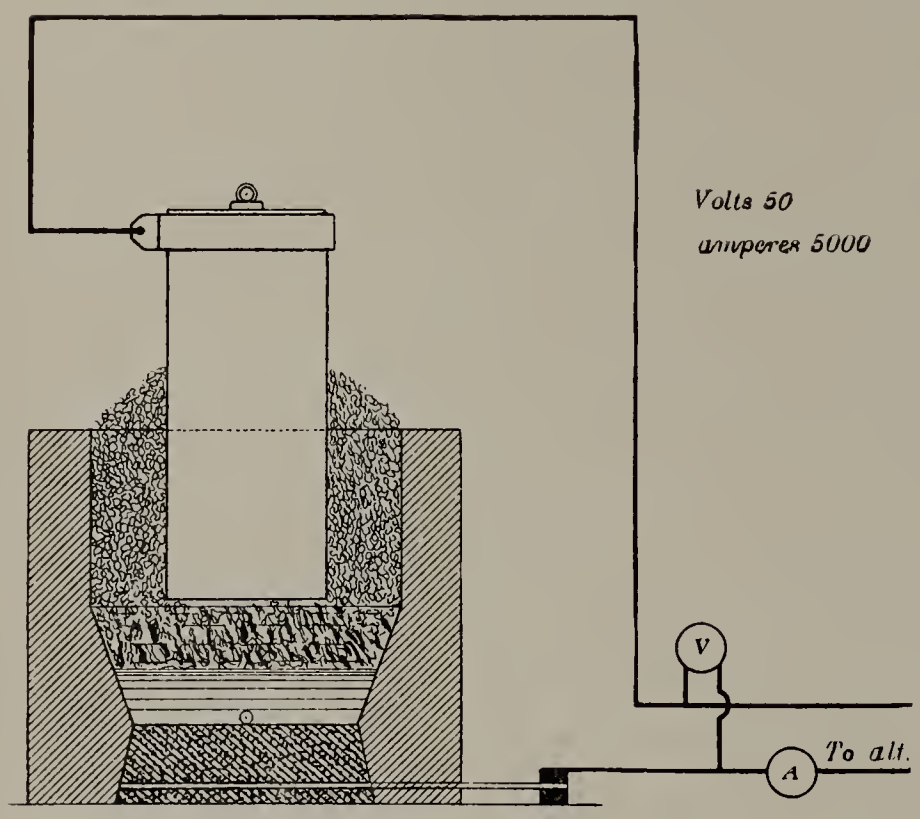
The Electric Smelting Plant at La Praz, France.



THE KELLER FURNACE AT LIVET, ISERE, FRANCE.



VERTICAL SECTION THROUGH A FOUR HEARTH KELLER FURNACE.

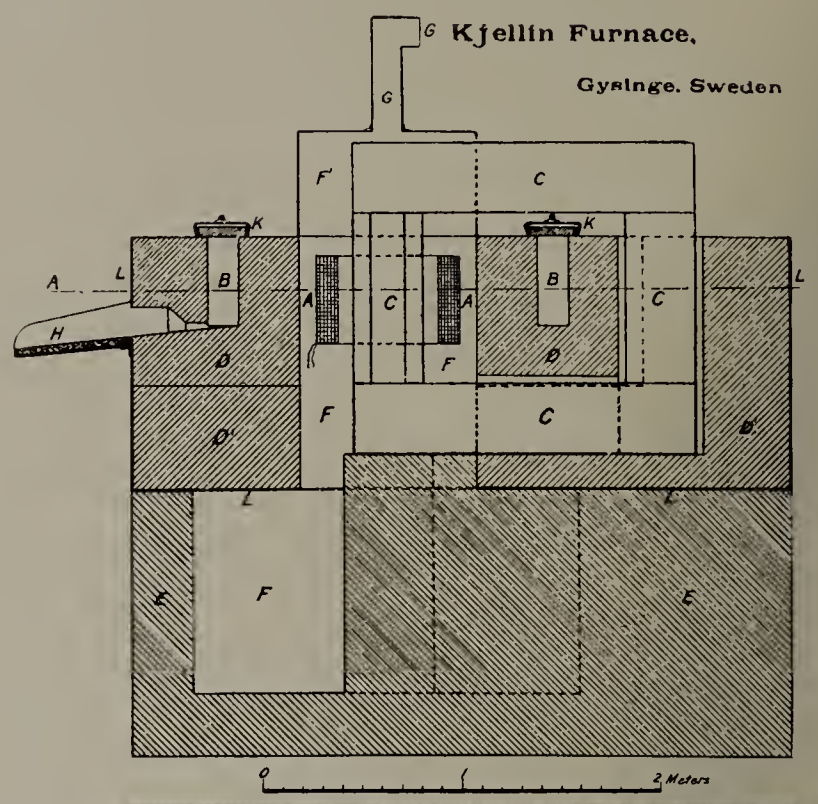


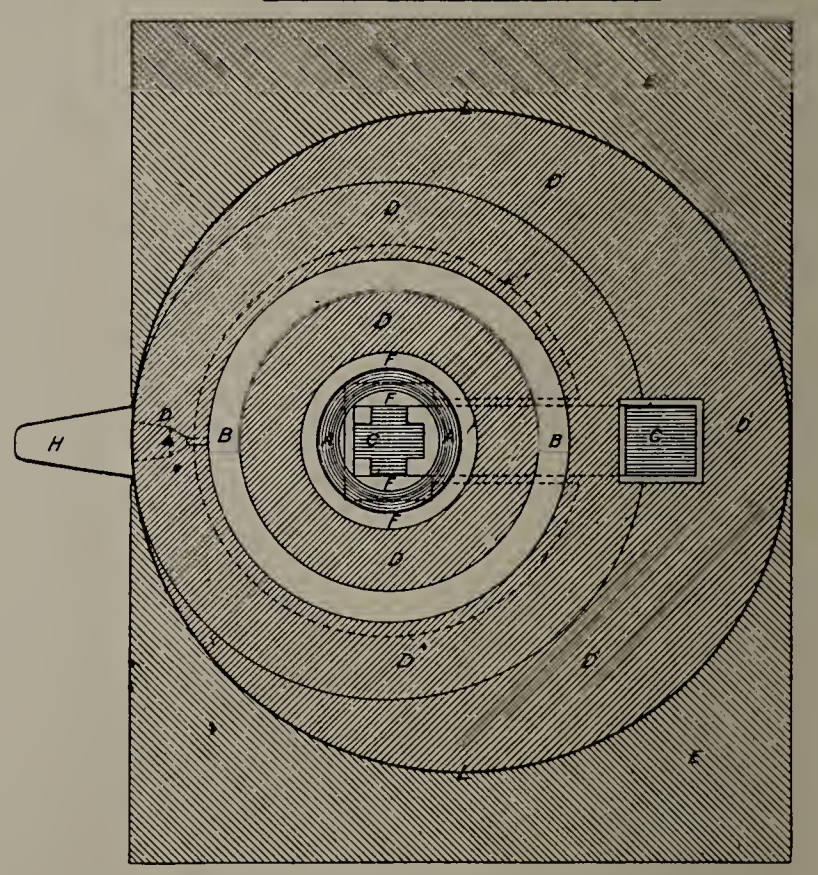
SECTION OF FURNACE AT LA PRAZ, FRANCE, SHOWING ELECTRICAL CONNECTIONS.

VERTICAL SECTION.

Kjellin Furnace,

Gysinge, Sweden





Section A B

HORIZONTAL SECTION, KJELLIN FURNACE.

signal to start the motor light, and, after it has gotten up to a fair speed to pick up the load with the friction and then throw the controller over to full speed. It will be noticed that this method of starting saved nearly 100 E.H.P. over the method of starting the load when the motor was at rest.

Starting Motor Light.

Instantaneous starting current.. ..	96 H.P.	for	5 seconds.
After starting with load on..	126 "	"	10 "
Full load full speed..	107 "	"	

Starting Motor with Load On.

Starting current..	194 H.P.	for	20 seconds.

This adoption of electricity for motive power in mining is the first we have knowledge of in Quebec; in British Columbia the Granby Consolidated Co. have made an electric installation for tramming, crusher and other purposes. There are many places in the Dominion where a substitution of electricity for steam would be most advantageous and economical. Had the original Montreal and London Company, operating the Dufferin Mine in Nova Scotia, utilized the water power of the Salmon River, that famous and still valuable gold property would not have cost its shareholders so much money. Electricity and good management will provide many dividends yet from this Nova Scotia mine, which has gotten a bad name through unscrupulous financiering and incompetent management.

Excerpts From the Report of the Electric Smelting Commission.

The following excerpts from the official report of the Commission appointed to investigate the Electro-Thermic processes are given to our readers as presenting, briefly, the salient points of the three furnaces which have actually done commercial work.

Kjellin Process.

At the Gysinge works, steel of superior quality is made by the smelting together of charcoal-pig and scrap in electric furnaces of the Induction type, i.e., furnaces without electrodes. The process does not permit the purification of the materials entering into the composition of the steel produced, the quality of the steel depending entirely upon the purity of the component materials employed. The process, therefore, corresponds to the crucible steel process, but has certain advantages over the latter, in that the melted material is at no time during the operation exposed to gases, which absorbed, deleteriously affect the quality of the product; moreover, the absence of electrodes, employed in all other classes of electric furnaces, avoids contamination of the molten material with the impurities which may be contained in the electrodes.

The Furnace.

Description:—

The furnace, of 225 H.P. capacity, is the invention of Mr. Kjellin, and is of the induction type, corresponding to a step-down transformer. Fig. 1 represents a vertical section through the tap-spout, and Fig. 2 a horizontal section through A B. The primary A A fig. 1 consists of a coil of insulated copper wire wound about one leg of the magnetic circuit C C C C. The secondary is formed by the charge contained in the annular grove B B. To the primary an alternating current of 90 amperes and 3,000 volts is delivered. This current induces in the charge forming the single turn of the secondary, according to Mr. Kjellin, a current of 3,000 amperes at 7 volts. The conversion of electric energy due to the resistance of the charge takes place, therefore, in the substance of the charge.

The furnace consists of a cylindrical iron casing L L, partly closed at the base, resting upon the brick foundation E E. The casing is lined with fire brick D' D', and the portion D D (as shown in figs, 1 and 2) is filled in with the exception of the annular grove B B, and the space F with magnesite or silica brick, according as a basic or acid lining is required for the grove, which forms the melting space or crucible.

The space F F, surmounted by the iron cylinder F', to which the pipe G is attached, serves the purpose of cooling the primary by the draft of air passing through it. In addition to the air draft, water circulation is employed to keep down the temperature in the space occupied by the primary. K K are covers for the annular crucible, and H the tapping spout.

The upper part of the furnace is at the same level as the working floor and the charging is effected by simply removing the covers K K, and putting in the material. Since the heat is produced in the metal contained in the annular crucible, the slag which has formed is at a much lower temperature than in other steel furnaces, and as a consequence the workmen suffer little from the heat.

The following figures, which could not be determined by the Commission relating to the efficiency of the furnace, are given by Mr. Kjellin:

From a series of trial runs, the production with this furnace averaged 4,100 kgs. in 24 hours, with a power of 165 kilowatts, or 225 electric horse-power. The loss of heat by radiation, transformation, etc., at a temperature of 1,400 degrees C, amounted to 80 kilowatts, this amount of energy being required to keep the temperature constant at 1,400 degrees C.

The temperature of the fluid metal at tapping is from 1,600 degrees to 1,700 degrees C.

The total efficiency of the furnace is 45½ per cent.

Plate I is a general view of the furnace in the act of being tapped.

The cost of a furnace of this type of 600 H.P. is, according to Mr. Kjellin, about $4,000.

Mr. Brown reports for charges Nos. 546 and 547 an absorption of electric energy per ton of product of 0.116 and 0.145 electric horse-power years respectively.

Mr. Harbord reports the estimated cost of steel by the Kjellin process to be $34.00 per ton of 2,000 lbs.

The capacity of the furnace is comparatively small, but for a larger plant Mr. Kjellin states that three furnaces of the pattern now used might be joined into a compound furnace, and supplied with a 3-phase alternating current. This would treble the capacity and reduce the wages, since the number of workmen now employed in operating the one furnace could attend to all three.

The La Praz Process.

Steel at the works of the Société Electro-Metallurgique Française at La Praz is made from scrap melted down, purified by the making of a number of slags, and carbonized in the furnace by carburite. This process, unlike that adopted at Gysinge, permits of the purification of the materials employed, and different grades of steel are made without difficulty.

The furnace is of the tilting pattern. It consists of an iron casing lined with dolomite brick, and magnesite brick around the openings. The hearth is formed of crushed dolomite,

rammed on top of the dolomite brick lining of the bottom of the iron casing. Two electrodes pass through the roof of the furnace, which, in the Kortfors furnace, were water jacketed for a short distance above and below their passage through the iron casing of the roof. The current passes from one electrode through the narrow air gap left between the electrodes and the slag line, into and through the slag to the molten metal, along it, through the slag and second air gap, to the other electrode. An alternating current of 4,000 amperes and 110 volts was delivered to the electrodes. The intensity of the current passing through the bath is regulated by adjusting the width of the air gap between the electrodes and the slag line. This adjustment is effected either by hand or automatically by a specially constructed regulator.

Mr. Héroult states that the cost of the furnace (charge 2,500 kgs.), building and necessary equipment, such as ladles, moulds, crane, etc., is about 50,000 francs, or $10,000. This does not include the turbines and electrical machinery.

Electrodes.

The electrodes are square prisms 360^{mm} on the side and 170^{cm} long. They are made from retort coke which contains from one per cent. to two per cent. of sulphur. The binding material is tar.

The coke delivered at La Praz costs 50 francs per metric ton, and the finished electrode 10 centimes per Kg.

The electrodes are not entirely consumed, and the short ends remaining are worked over into new electrodes, at a cost of two centimes per Kg.

The plant for making electrodes for one furnace is estimated by Mr. Héroult to cost $5,000.

In a memorandum furnished me by Mr. Harbord, at La Praz, the estimated cost of converting scrap into steel by the Héroult process, exclusive of cost of scrap and metal, amounted to $14.00 per ton of product.

Keller Process.

The furnaces employed for these experiments were the furnaces used in the regular work of making, by the electric process, the various ferros such as ferro-silicon, ferro-chrome, etc. The company, at the time of our visit, was engaged in filling a rush order for ferro-silicon, but generously interrupted their pressing regular work to undertake the making of the experiments for the Commission.

Furnace.

Description:—

The furnace is of the resistance type, and consists, see Plate X, of two iron casings A and B of square cross-section, forming two shafts communicating with each other at their lower ends by means of a lateral canal. The casings are lined with refractory material. Two different classes of furnaces were used for the experiments. In the case of the first furnace employed, the lateral canal was widened out at its centre to form a reservoir for the accumulating melted metal, from which it could be tapped after the slag had been withdrawn from tap-holes, one for each shaft, situated at the lower end of the shaft, at a higher level than the tap-hole of the reservoir.

The base of each shaft is provided with a carbon block. These blocks are in electric communication on the exterior of the furnace by means of copper bars. The carbon electrodes to which the electric current is distributed pass two-thirds of their length into the shaft.

Method of Charging.

In starting the furnace the charge is introduced between the carbon blocks of the base and the ends of the electrodes, which latter are then in their lowest position. The current passes from one electrode through the material to be reduced to the carbon block, from thence outside of the furnace by means of the copper conductor to the other carbon block, through the charge in the second shaft, and to the other electrode. The current meeting in the two shafts with the resistance of the charge, the latter is heated, the reduced metal flowing along the canal conducts the electric current from one electrode internally to the other electrode. The exterior current diminishes as the amount of reduced metal increases. The electrodes are now raised, the charging continues, until finally the electrodes occupy their normal positions, and the shafts below the electrodes, and between the electrodes and the sides of the shafts, are completely occupied by the charge. Under these conditions but a small current flows through the external conductor, the main current passing within the furnace from electrode to electrode. This ingenious arrangement of providing a shunt for the current enables the furnaces to be worked continuously, without at any time varying excessively the load on the alternator.

Electrodes.

The electrodes are formed by an assemblage of four electrodes of square cross-section, 280 millimeter on the side, into a single mass of square cross-section, 850 millimeter on the side, and 1.4 meters long.

The dimensions, measured after forty-eight hours of working, showed that the decrease of the electrodes in length was very slight. This can be understood when it is considered that the electrodes are but little affected by the passage of a current of relatively low density; the parts of the electrodes not in contact with the charge do not become heated, and the heated ends are completely submerged in a reducing medium.

Two electrodes, which had already been in operation for forty-eight hours at the beginning of the test, were still in operation thirteen days later. On the date of our departure these electrodes were still one meter long, their original length having been 1.4 meters.

Experiments.

Three sets of experiments were made for the Commission:

1st.—Electric reduction of iron ore and obtaining different classes of pig: grey, white and mottled.

2nd.—Electric reduction of iron ore containing a definite amount of carbon in the charge, with a view of ascertaining the amount of electric energy absorbed in the production of one ton of pig iron.

3rd.—The manufacture of ordinary steel of good quality from the pig manufactured in the preceding experiments.

The different classes of pig iron, grey, white and mottled, were obtained without difficulty.

Throughout the experiments the furnaces worked quietly, and without the slightest accident; the gases discharging on top in flickering flames, showing that the gas resulting from the reduction of the ore escaped at low pressure. The workmen were ordinary Italian laborers, without any special training.

The energy absorbed per ton of pig produced is reported by Mr. Brown to be 0.475 E.H.P. years for the run, with furnace of 1,000 H.P. capacity, with an average current of 11,000 amperes at 60 volts, and 0.226 E.H.P. years for the run with furnace of 308 H.P. capacity, with an average current of 7,000 amperes at 55 volts.

Cost of Production of Pig by the Keller Process.

Mr. Keller's estimate of cost per ton of product, based on the energy consumed in the second experiment, and found to be 0.226 E.H.P. years, is as follows:—

1. Ore (Hematite, 55 per cent. iron), 1.842 tons at $1.50 per ton	$ 2.76
2. Coke, 0.34 tons, at $7.00 per ton	2.38
3. Consumption of electrodes $45.00 per ton, 34 lbs per ton of iron	0.77
4. Lime, 300 lbs., at $2.00 per ton	0.30
5. Labor, at $1.50 per day	0.94
6. Electric energy, 0.226 H.P. years, at $10 per H.P. year	2.26
7. Miscellaneous materials	0.40
8. Repairs and maintenance	0.20
9. General expenses	0.20
10 Amortization (machinery and buildings)	0.50
Total, exclusive of Royalty	$10.71

Mr. Harbord has furnished reasons for assuming the mean of the determinations of the two sets of experiments made, i.e., 0.350 E.H.P. years, to be a safer figure on which to base the calculation of cost per ton of pig produced. With this change in the amount of E.H.P., and 100 lbs. additional of lime, the cost per ton of pig is $12.05.

Machine Coal Cutting.

The following resumé of the advantages and disadvantages of using coal cutting machinery where circumstances warrant it is excerpted from a paper by Mr. Charles Bell, which was printed in a recent issue of "The Science and Art of Mining." That so small a percentage of coal in Great Britain is won by machines has been noted by coal men and machinery supply houses, and has been a matter of surprise. The use of such machinery obviates any difficulties due to idiosyncrasies of miners, and secures a regular output, and an approximately fixed standard of cost.

The advantages claimed by machine coal cutting are as follows:—

1.—A reduction in the cost of getting the coal. The amount of reduction varies owing to the local conditions of the mine. There are some cases where a saving of 1s. per ton has been effected, while in others the difference runs from 3d. to 9d. per ton less than by hand labour.

2.—An increased production per man. The increase of coal got per man employed, by machine coal cutting, is exceedingly great, varying from fifty to seventy-five per cent. more. The greater output from a given length of face implies that less pit room will be required, concentration of the workings, and consequently an indirect saving of production. A less number of men will be required for the same output, which means a saving in houses and rent.

3.—An increased percentage of round coal. Where the selling price depends upon the size of the coal, it is evident that any increase in the percentage of round coal is a matter of great importance. In hand labour a large percentage of the seam is cut to waste by the hewer in kirving. In coal cutting by machines only a few inches is cut out, and sometimes the cutting is performed in the under-clay. The increase, however, is not so great in a seam where the hand cutting is performed in the under-clay and not in the coal itself. The average amount of increase varies from seven to twenty per cent.

4.—Thin seams can be worked to advantage. Coal-cutting machines compete more successfully in thin seams than in thick ones, as it replaces more costly labour, and, therefore, raises the value of the thin seams to a nearer comparison with the thick seams. Seams only fourteen inches in thickness have been worked to advantage by machinery, which could not be said of hand labour.

5.—The rate of accidents is considerably reduced. The position of the miner is greatly improved by machine cutting, due to the quick advancement of the working face and the abolition of the peculiar attitude in kirving. In America, where coal cutters are extensively used, we find that the death-rate by accidents is considerably reduced where machines are working, and that mines where the largest percentage of the coal was produced by machines had the lowest death-rate. In our own country, in the district of Yorkshire, we are told that 1,270,000 tons had been produced in the Silkstone seam by machines for the same number of reported accidents as 360,000 tons by hand labour.

6.—The cost of timber and explosives is reduced. By the rapid advancement of the face the timber drawn from the goaf is in a fairly good state, and can be used again. The long line of face, together with the deep undercut, had, in some cases, rendered the use of explosives unnecessary; in others, the number of shots had been considerably reduced.

The chief disadvantages to the use of these cutters are:—

1.—The enormous first cost. A very large sum of money has to be expended in the purchase of boilers, air compressors or electric generators, and foundations for the surface machinery; then there is the long length of pipes or cable, the wear and tear of the machinery, the cost of maintenance, and the interest on capital.

2.—Favourable terms for hand labour. In some coal-fields we find special favourable terms for hand labour arranged, and coal-cutting machines are never likely to be introduced.

3.—Difficulty encountered with bad roofs. A great amount of difficulty is sometimes encountered in a seam with a bad roof. The roof may be so tender as to require very careful timbering, which prevents the rapid movement of the machines along the face, and, therefore, the amount of work got out of the machine is very small.

4.—Seams not adapted to coal-cutting by machinery. We are told that, owing to the makers not readily adapting their machines to the varying difficulties of different seams, there was a considerable amount of difficulty to be overcome to enable these particular seams to be worked advantageously. A faulty seam presents a great disadvantage to the use of the machines.

The Huntington-Herberlein Process.

(From the "Lead and Zinc News.")

An interesting description of the Huntington-Herberlein process has been contributed by Donald Clark to the "Mexican Investor." This process is being installed by the Penoles Mining Company at Mapimi, Mexico, and is the first plant of its character installed on this continent.

The Huntington-Herberlein process was patented in 1897 and is based upon the fact that galena can be desulphurized by mixing it with lime and blowing a current of air through the mixture.

If the temperature is dull red at the start, no additional source of heat is necessary because the reaction causes a great rise in temperature. The chemistry of the process cannot be said at present to have been worked out in detail. The patentees found that by mixing lime and galena together and heat-

ing the mixture in air to seven hundred degrees C. and then allowing to cool to a dull red heat, that oxygen was given off, sulphur dioxide being simultaneously evolved. At this point, if air is forced through the mixture, the temperature rises and the operation becomes continuous, the oxygen acting on the galena as long as any sulphur dioxide remains in the mixture. Concentrated fumes of sulphur dioxide are given off and the mixture gradually fuses to a mass of lead oxide in conjunction with the gangue of the ore treated. The reactions provisionally given by patentees are :—

(1) At 700° C. $CaO + O = CaO_2$.
(2) At 500° C. $4CaO_2 + PbS = PbSO_4 + 4CaO$.
Combining (1) and (2). $4CaO + PbS + 4O = PbSO4 \div 4CaO$.

In other words, lime heated to 700 degrees C. absorbs oxygen and becomes dioxide, which reverts to lime again on cooling, but if lead sulphide is present this is attacked and converted into sulphate. After the change, at the temperature due to these reactions, lead sulphide reacts with lead sulphate, giving lead oxide and sulphur dioxide.

(3) $PbS + 3PbSO_4 = 4PbO + 4SO_2$.

These reactions, given by the patentee, are not satisfactory, since calcium dioxide is only formed at low temperatures and is readily decomposed on gently warming it; lead oxide, however, combining with oxygen under suitable conditions at a temperature not exceeding 450 degrees C. forms a higher oxide, and it is probable that this unites with the lime to form calcium plumbate. The reaction between sulphides and lime, when intimately mixed and heated, may be put down as

$$CaO + PbS = CaS + PbO.$$

In contact with the air the calcium sulphide oxidizes rapid-
FIVE—MINING
ly to sulphite, then to sulphate, then reacts with lead oxide giving calcium plumbate and sulphur dioxide.

$$CaSO_4 + PbO = CaPbO + SO_2$$

Further, calcium sulphate will also react with galena, giving calcium sulphide and lead sulphate; the calcium sulphide is oxidized (by air blown through) to calcium sulphate again, the ultimate reaction being

$$CaSO_4 + Pbs + O = CaPbO_3 + SO_2$$

In all cases the action is oxidizing and desulphurizing. It was found that oxides of iron and manganese will, to a certain extent, serve the same purpose as lime. In the case of zinc sulphide the decomposition is probably due to the interaction of sulphide and sulphate.

$$ZnS + 3ZnSO_1 = 4ZnO + 4SO_2$$

The process has now been adopted by the Broken Hill Proprietary Company at their works at Port Pirie, Australia; the Tasmanian Smelting Company, West Australia, and the Sulphide Corporation's works at Cockle Creek, New South Wales. The operations carried on at the Tasmania Smelting Works comprise mixing pulverized limestone, galena and slag-making materials and introducing the mixture either into hand-rabbled reverberatories or mechanical furnaces with rotating hearths. After a roast, during which the materials have become well mixed and most of the limestone converted into sulphate and about half of the sulphur expelled, the granular product is run, while still hot, into the Huntington-Herberlein converters. These consist of inverted sheet-iron cones, hung on trunnions, the diameter being 5 feet 6 inches and the depth 5 feet. A perforated plate or colander is placed as a diaphragm across the apex of the cone, the small conical space below serving as a wind box into which compressed air is forced. A hood above the converter serves to carry away waste gases. As soon as the vessel is filled, air under a pressure of 17 oz., is forced through the mass, which rapidly warms up, giving off sulphur dioxide abundantly. The temperature rises and the mixture fuses, and in from two to four hours the action is complete. The sulphur is reduced from ten to one per cent., and the whole mass is fritted and fused together. The converter is emptied by inverting it, when the sintered mass falls out and is broken up and sent to the smelters. There are 12 converters, of the size indicated, for the two mechanical furnaces, of 15 feet diameter. Larger converters of the same type were erected to deal with the product from the hand-rabbled roasters.

At Cockle Creek, New South Wales, the galena concentrate is reduced to 1.6 mm., the limestone is crushed down to from 10 to 16 mesh, silica is also added, if it does not exist in the ore, so that, excluding the lead, the rest of the bases will be in such proportion as to form a slag running about 20 per cent. silica. The mixture may contain from 25 to 50 per cent. lead, and from 6 to 9 per cent. lime; if too much lime is added the final product is powdery, instead of being in a fused condition. This is given a preliminary roast in a Godfrey calciner. This furnace has a rotating bed and a low dome-shaped roof. Ore is fed through a hopper at the center, and deflected outward by blades attached to a fixed radial arm. At each revolution the ore is turned over and moved outward, the amount of deflection of the blades, which are adjustable, and rate of rotation of the bed, determining the output. The furnace for supplying the hot air is placed at one side, and the gases are made to travel over the ore before leaving by a flue. A constant stream of hot semi-roasted ore is discharged through a slot at the circumference of the roaster. This may contain from 12 to 6.5 per cent. of sulphur, but from 6.5 to 8 per cent. is held to be the most suitable quantity for the subsequent operations. Thorough mixing is of the utmost importance, for if this is not done the mass will "volcano" in the converter, that is, channels will form in the mass through which the gases will escape, leaving lumps of untouched material alongside. The action can be started if a little red-hot ore is run into the converter and cold ore placed above it; the whole mass will become heated up, and the products will fuse, and sintel into a homogeneous mass showing none of the original ingredients. At Cockle Creek the time taken is stated to be five hours; a small air pressure is turned on at first, and ultimately it is increased up to 20 ounces.

Operations at Port Pirie are conducted on a much larger scale. A mixture of pulverized galena, powdery limestones, ironstone and sand is fed into Ropp furnaces, of which there are five, by means of a fluted roll placed at the base of a hopper. Each roaster deals with 100 tons of the mixture in 24 hours. About 50 per cent. of the sulphur is eliminated from the ore by the Ropp (the galena in this case being mixed with a large amount of blende, there being only 55 per cent. of lead and 10 per cent. of zinc in the concentrate produced at the Proprietary mine). The hot sand from the roasters is trucked to the converters, there being 17 of these ranged in line. The converters here are large segmental cast-iron pots hung on trunnions; each is about 8 feet diameter and 6 feet deep, and holes an 8-ton charge. At about two feet from the bottom an annular perforated plate fits horizontally; a shallow frustrum of a cone, also perforated, rests on this; while a plate with a few perforations closes the top of the frustrum. The whole serves as a wind box. A conical hood with flanged edges rests on the flanged edges of the converter, giving a close joint. This

hood is provided with doors which allow the charge to be barred if necessary. A pipe about 1 foot 9 inches in diameter, fitted with a telescopic sliding arrangement, allows for the raising or lowering of the hood by block and tackle, and thus enables the converter to be tilted up and its products emptied. The cast-iron pots stand very well; they crack sometimes but only two pots have been lost in 18 months.

Air enters at a pressure of about 24 ounces and the time taken for conversion is about four hours. The sulphur contents are reduced to about three per cent. It is found that the top of the charge is not so well converted as the interior. There is practically no loss of lead or silver due to volatilization and very little due to escape of zinc. It has also been found that practically all the limestone fed into the Ropp is converted into calcium sulphate; also that a considerable portion of lead becomes sulphate, and it is considered that lead sulphate is as necessary for the process as galena. The value of the process may be judged from the fact that better work is now done with 8.5 foot furnaces than was done with 13-foot before the process was adopted.

In addition to the sintered product from the Huntington-Herberlein pots, sintered slime, obtained by heap roasting, and flux consisting of limestone and ironstone are fed into the furnaces, which take 2,000 long tons per day of ore, fluxes, and fuel. The slags now being produced average: SiO_2, 25 to 26 per cent.; FeO, 1 to 3 per cent.; MnO, 5 to 55; CaO, 15.5 to 17; ZnO, 13; Al_2O_3, 6.5; S, 3 to 5; Pb, by wet assay, 1.2 to 1.5 per cent; and Ag. 0.7 oz. per ton. Although this comparatively large quantity of sulphur remains, yet no matte is formed.

In their strenuous efforts to obtain a higher tariff the manufacturers sometimes say, or are reported to have said, some very silly things. In a recent speech by Sir Howard Vincent on Canadian trade, he made allusion to the new regulations against "dumping" foreign rails into Canada, and quoted tables shown to him by a Canadian manufacturer (erroneously dubbed the largest iron master in the Dominion) whereby it was shown that steel rails imported from Sheffield into Canada would, under the new regulations, "pay only $5.23 a ton against $14.37 on German rails and $11.76 on American rails."

All this on one side, and on the other side assurances are given that Canada will supply itself with steel rails, that the Sault Ste. Marie works and the Sydney works can more than supply the domestic demand. Where, we ask, is the comfort to the Sheffield manufacturer? If he could get what he wants he will pay $5.23 a ton for doing so, but the "Canadian Ironmaster" has so many rails to sell that "no rails need be imported."

Copper producers, and the copper market generally, has witnessed a steady increase in the price of copper during the last three or four months, and the price for metallic copper in December is one of the highest of recent years. The markets for the last thirty days have shown a range from twelve and a half cents to fifteen cents per pound, with the demand steadily increasing. The well-known English house of Merton & Co. have provided the following figures of production, from which the enormous increase of consumption is easily gathered:—

	World's Production. Tons.	United States. Tons.	Spain and Portugal. Tons.	Other Countries. Tons.
1880	154,000	27,000	36,000	91,000
1885	225,000	74,000	48,000	103,000
1890	269,000	116,000	52,000	101,000
1895	334,000	170,000	55,000	109,000
1900	485,000	269,000	53,000	164,000
1901	519,000	267,000	54,000	197,000
1902	542,000	295,000	50,000	198,000
1903	566,000	299,000	50,000	217,000

Pumping Plant for Comstock Mines.

One of the most important deals in mining machinery ever made on the Pacific coast was closed in San Francisco recently. This was the awarding of the contract for the permanent pumping plant which is to drain the middle group of mines upon the Comstock lode to the vertical depth of 3,000 feet through the Ward shaft. The successful bidders were the International Steam Pump Company, of New York, whose works are in Harrison, New Jersey, and the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pennsylvania. The contract price is about $80,000.

The Ward Shaft Association, which authorized the awarding of the contract, is composed of the Comstock mining companies: Gould and Curry, Savage, Chollar, Potosi, Bullion, Alpha Consolidated, Exchequer and Julia Consolidated. These companies own and operate ground nearly a mile in length in the middle part of the Comstock lode. The northern half of this ground has yielded considerable pay ore from the deepest points of nearly 3,000 feet, while large and well mineralized quartz bodies have been discovered in the southern half down to the 2,500-foot level, which could not be explored owing to a great inburst of water some twenty years ago, which has since flooded all the middle mines nearly up to the 1,600 or the Sutro tunnel level.

The contract calls for two first-motion, electrically-driven Express pumps, each of the units to have a capacity for lifting 1,600 gallons of water per minute, against a pressure equivalent to a height of 1,500 feet, or from the 3,000-foot level up to the level of the south lateral branch of the Sutro tunnel. Each pump to be driven by an 800 horse-power, slow-speed induction motor. The $80,000 contract just awarded includes, besides 600 feet of 16-inch pump column pipe (the Ward Shaft Asociation already having 900 feet on hand), a travelling crane for the pump station, an automatic oiling system, a small air compressor for filling the air chambers, a small vacuum pump for discharging the vapor from the suction chamber, all the piping and valves of every description for completing the installation, and a complete set of duplicate parts of the pumps. The contract price also includes all freight and insurance charges to Virginia City.

Magnetic separating plants for low grade zinc ores have been extensively introduced into the Wisconsin field, with the effect of raising market prices for such ores to a considerable extent. The result of the introduction of these plants is that both the lead and zinc interests in Wisconsin are in a more favorable condition than they have been for many years past. The increase of new concentrating plants and the total production of the district have both been the heaviest in the history of the section.

The Centre Star Annual Meeting.

The sixth annual meeting of the Centre Star Mining Company was held in Toronto on Tuesday, the 29th of November, when the following profit and loss account for the year was submitted:—

Dr.

To Cost of mining and development	$227,507.20
Diamond drilling	7,110.39
Legal expenses	11,200.12
Managing Director's salary	2,500.00
Mine accounts	189.15
Travelling expenses	450.09
Auditors' fees	160.00
Head Office expenses	781.74
Investigation of ore processes	993.64
Sundry expenses	1,023.79
Depreciation	19,442.29
	$271,358.38
Balance (net profit)	165,183.70
	$436,542.08

Cr.

By Balance brought forward	$150,789.36
Net proceeds of ore sales	279,252.63
Interest	6,447.84
Transfer fees	43.25
	$436,542.08

It will be noted that the balance to debit of Profit and Loss is only $14,394.34 in excess of the balance brought forward from last year.

Speaking to the shareholders, the president wandered a little afield in talking about the total production of the two mines (War Eagle and Centre Star) since discovery, and in dwelling on the fact that sixty per cent. of the value produced had been spent in freights, smelting, refining and marketing, and the remaining forty per cent. in labor and

supplies; he was, in fact, courageous enough to state that so far as the War Eagle Company was concerned, it had borrowed a large amount in addition. What Mr. Gooderham did not do, was to tell his shareholders what reasonable grounds the directorate had for believing that this discouraging state of affairs would soon be remedied. The full report has not yet been printed and issued to the shareholders, and comment must be deferred until its receipt. Mr. Gooderham's address was as follows:—

"As you are aware, it has been apparent for some years past that the chances for large dividends from Rossland mines were doubtful unless a much cheaper method of treatment could be devised than that which has hitherto obtained. Our manager has reported from time to time during the past four years that such methods of treatment were possible; but for one reason or another it seems impossible for him to secure the facilities necessary for such a plant, such as a suitable site, abundance of water, and cheap freight rates. However, a year ago last August, these difficulties were overcome, and the Rossland Power Company was shortly afterwards organized for the purpose of building and equipping a concentrating and cyaniding mill near the smelter at Trail, but owing to many unforeseen difficulties, Mr. Kirby appears to have been unable to get the mill into running order until within the last few weeks, and up to the present time we have not been advised that it is running smoothly. The usual difficulties which naturally arise in starting a large plant such as this have been met with, but are being gradually overcome.

"Everything to-day is turning upon the success of this and other mills which are being installed in Rossland. This will be apparent when I tell you that the Centre Star and its sister mine, the War Eagle, which have been operated under the same management, have so far produced 553,932 tons of ore, which has averaged about $14.40 per ton, or a total value of $8,076,661. Of this, more than $4,872,834 has gone to pay railways and smelters for freight, treatment, refining, and marketing charges. The balance, amounting to about $3,200,000, has been received by these mines, and the whole of this has been by them disbursed for labor and supplies in connection with the mining of the ore and the development and equipment of the mines; and I may say that, so far as the War Eagle is concerned, a large amount has been borrowed in addition.

"It will be seen from this that we have been producing from these mines, during the past seven years, about $4,000 in market values of gold, silver and copper for every working day; and undoubtedly everybody, miners, merchants, railways, smelters, refineries, and indeed the whole country, has been making a good thing out of the wealth thus produced, except those whose capital produced it. The fact of the matter is, that the cost of mining at Rossland is probably higher than at any of the other points in the world at which these metals are being produced in like quantities. The object of the mill is, in a measure, to meet this difficulty by affording some cheaper method of treatment of low grade ores than by smelting, and the plan has been hit upon of concentrating out the copper sulphides for the smelter and extracting the gold from the balance by the cyaniding process."

The Mining Section of the Canadian Society of Civil Engineers.

The first meeting for this season of the mining section of the Canadian Society of Civil Engineers was held at the headquarters of the Society, on Dorchester Street, Montreal, on Thursday evening, December 8th. Dr. J. B. Porter, chairman of the section, presided. The papers of the evening were: one by Mr. C. H. MacDougall, on "The Flue-dust Problem at Anaconda, Montana," and one on "The Centre Star Mine, at Rossland, B.C.," by Mr. L. H. Cote. Both papers were illustrated by lantern slides, those of the latter being made from some unusually fine underground photographs. There were present at this meeting Prof. C. H. McLeod, Mr. Phelps Johnson, Mr. James A. Jamieson, Mr. W. J. Sproule, Mr. E. A. Rhys Roberts, Dr. Alfred Stansfield, Mr. F. Cirkel, Mr. J. Burley Smith, Mr. John F. Robertson, Jr., Mr. James M. McPhee, Mr. H. Wilson, Mr. J. G. Kerry and many others.

It was announced that, at the meeting of the section to be held on February 9th, a paper would be read by Dr. Stansfield, and that later a paper prepared jointly by Messrs. Davidson and McKenzie, of the Dominion Coal Company, on "The Cause and Effects of the Fire in Dominion, No. 1," would be presented.

The Review announces that it will publish these papers in subsequent issues for the benefit of its readers, and it hopes to be able to make such arrangements as will permit of the publication of all of the Mining Section papers immediately after they have been read before the Society. The admirable Journal of the Canadian Society of Civil Engineers is a yearly publication, and many papers of great interest are thereby delayed in their introduction to public notice; their prompt publication will be of great benefit to our readers and to the mining public generally.

Kryptol.

In our October issue we printed a notice of a new German invention known as "Thermit," by which intense heat is generated for special uses in a very short time, and by chemical action, entirely without electricity or any other outside aid. Another German invention to be used for heating in connection with electricity has been announced this month, and the name by which it is to be known to the trade is Kryptol.

Kryptol is a heat-resisting material made by mixing (in correct proportions) graphite, carborundum and clay, so combined as to form a granular mass. This substance offers to the passage of an electric current a sufficient amount of resistance to generate a high degree of heat without being itself destroyed. It avoids the use of platinum, nickel or any metals which have been heretofore used in resistance furnaces, thereby securing economy and avoiding danger from short circuiting.

The form in which Kryptol is applied (so far) is as follows: An earthenware plate, usually about two feet square, is enclosed in a wooden frame from which, at two opposite sides, project two carbon electrodes which rest upon the plates and which are connected by insulated wires with the current supply. Upon this earthenware plate the granulated kryptol is loosely strewn to the depth of about one inch. When the kryptol powder connects with both electrodes, a circuit is closed, and the kryptol becomes heated if the thickness is diminished. Or, by brushing the powder away from one electrode, the circuit is broken. If only a thin layer is used, the kryptol becomes heated and will sparkle and glow when the current is on, generating heat so quickly as to raise water to the boiling point within four minutes.

The finer the grains the less active the resistance, and the less heat is obtained; for regulating purposes, therefore, the kryptol is at present manufactured in grains of four sizes. The extreme tractability by which the temperature can be regulated by increasing or decreasing the thickness of the layer on the plate renders this substance applicable to a great variety of practical purposes. It has been used for heating railway and street cars, houses, rooms, etc., etc.

The new material has been adopted by the laboratories of the University of Berlin, the Technical College at Aix la Chappelle, the Imperial Health Office, and other state institutions in Germany.

OBITUARY NOTICES.

Col. John Leahy, formerly a brewer in Vancouver, but more recently prominent in mining affairs, died on Thanksgiving Day, at the age of sixty. Col. Leahy came to Canada in 1878, and followed gold mining a short time, after which he engaged in the brewing business. At one time, recently, the deceased owned large areas of coal lands in Grahame Island.

Mr. John Bertram, president of the Bertram Engine Works, Toronto, died at his home on November 18th, after an illness of nearly six months. Mr. Bertram was of Scotch descent, and came to Canada at the age of twenty-three. He first engaged in the hardware business in Peterboro', Ont., and subsequently went into the wholesale hardware trade in Toronto, from which the organization of the engine works was the final product. Mr. Bertram, though not in active politics, was a staunch Liberal. He was an M.P. from Ontario some thirty years ago, and at the time of his death was chairman of the Transportation Commission.

Captain John R. Gifford died on Tuesday evening, the 23rd of November, at the Hayward Hotel, Hayward, California, at the age of fifty-five.

Capt. Gifford was born in Cornwall, and for a long time was in the service of the celebrated firm of John Taylor & Sons, as mine manager, in various districts in Australia and Mexico. His first acquaintance with Canada was in the capacity of manager for an Ontario mine, known as the "Boulder," in the Lake of the Woods district, where he established a record for economy and speed of development which that district has never seen either before or since. He left Ontario to take charge of the mines of the Hall Mining & Smelting Co., in 1899, and remained with that company until 1902, when he removed to San Francisco and opened an office as consulting engineer. Last year Capt. Gifford spent in Mexico, and this fall, about the end of September, went to Goldfields and Tonapah, Nevada, where he acquired several claims for himself, and was engaged in development work upon them when he contracted a severe cold which sent him back to his wife at Hayward to die.

Capt. Gifford had been for some years a sufferer with catarrh of the stomach, which was the immediate cause of his death. He was one of the best known mining men on the Pacific coast, and his friendship was prized by all who were fortunate enough to know him.

For ability to size up a mine, to develop it, and to conduct operations economically he had few equals. The mining fraternity loses a good member in his death.

GEOLOGICAL SURVEY NOTES.

With one or two exceptions, all the field geologists have returned to Ottawa and are now busy on the work of plotting their surveys and digesting their field notes. Owing to the small appropriation, the members of the Survey have still to act in the dual capacity of topographers and geologists.

During the year 1904 the large annual volume of the summary reports and special publications to the number of about twenty, in the shape of bulletins on economic minerals, have been prepared, but the King's Printer has not kept pace with the manuscript. Some of these have been printed and issued, but many have not.

A bulletin on the peat areas of the Dominion, by Dr. Robert Chalmers, has been recently issued. It gives the total area of the fields, as known at present, as 37,000 square miles, but assurance is made that further explorations will greatly increase this area. The bulletin also describes the various processes for manufacturing peat which are now being used in Canada.

About thirty parties have been in the field this season, and each year witnesses an increase in the operations of the Survey; this year the usual fields have been covered, and a party sent as far north as Lancaster Sound in the Arctic regions. The gold and coal areas of Nova Scotia and British Columbia, the possible copper areas in Quebec, Ontario and British Columbia, the iron resources of divers localities, and the minor minerals in various portions of the Dominion have all received attention.

As in the past, too much immediate attention has perhaps been given to the exploring of unknown sections, which (though valuable ultimately) will not attract population or exploitation for years to come. With the advent of the Grand Trunk Pacific, however, no one can tell in what unexpected or, at present, improbable directions development may occur, and the Survey is covering the whole area of the Dominion reconaissance work very rapidly.

Dr. Robert Bell remains Acting Director of the Survey, no Director having been appointed since the death of Dr. Dawson. Dr. Bell has had the experience of forty-seven years in the department, and has been Acting Director for four years. It would seem that either his appointment as director should be made, or a new Director appointed, as at present Dr. Bell has all the work and responsibility of both offices, viz., the Director and the Deputy Director—a double load and burden to which no man should be subjected, and under which no one man can be expected to do the best that is in him.

BOOK NOTICES.

The Review has received from John Wiley & Sons, publishers, New York City, a copy of Notes on Assaying, by Prof. R. W. Lodge, of the Massachusetts Institute of Technology. In addition to the book being a most excellent compendium for the assayer, Professor Lodge has included in it some sixty pages of notes on metallurgical methods and experiments which have been made and used at Technology in connection with the larger laboratory tests which are required at that institution for fourth year students when working on their theses for degrees.

The book was specially written for the use of students at Technology, but has a large value to all practical assayers, and is a welcome addition to all assaying literature.

The chapter on the Assay of Ores for Gold is the best we have yet seen in any text book; Professor Lodge lays stress at the very beginning upon the difficulties attending the assay of material which carries a very low percentage of the metal sought, instancing the fact that an ore worth ten dollars in gold to the ton carries only .0005 of a gramme to the assay ton. In speaking of ores carrying tellurium, he mentions one fact which we have not noticed in previous works—that the main point in the assay of tellurium ores is that they shall be ground to pass at least a 150 mesh screen if satisfactory results are desired, or, the richer the ore the finer should be the mesh through which the ore is passed.

The pages on the assay of zinc box residues from the cyanide process have been published in the Transactions of the American Institute of Mining Engineers, but their incorporation in these notes is most desirable. To the young or just graduating engineer we can heartily commend the pages of Metallurgical Laboratory Experiments, which point to such neophytes many ways of doing things correctly in practice which are not usually taught to students in the university. We note particularly, the apparatus for chlorination tests, some valuable remarks on the barrel process of chlorination, a page of chemical reactions which occur in the cyanide process and which are here grouped succinctly together. Also valuable are the remarks on the experimental treatment of gold-bearing ores and on making silver amalgam for accurate plate work in mill tests.

The book is one that can be cordially and heartily recommended to be placed upon the shelves of every practising engineer and metallurgist.

Mining Share Market.

The market for mining shares has been neglected, and transactions extremely light. During the early part of the month there was some demand for War Eagle and Centre Star, consequent on the annual report of the latter company; but the apparent failure of the new reduction process has given these securities a set-back. Granby Consolidated has declined a little in common with other copper shares, but there is still a fairly active business doing in the shares.

In the industrial list there has been a fair amount of trading, and prices are firm, the most active being Dominion Iron & Steel, preferred and bonds, both of which have scored a considerable advance. There is no particular reason to account for this, beyond the general satisfactory condition of trade and the bullish character of the speculative market.

The sensational movement in Montreal and Boston, which carried the stock up to $3.50 and ended in the collapse of the syndicate, and the sharp decline to 50 cents, has had no effect here, as the boom was engineered on the curb market in New York, and did not extend to this one.

The following list shows the quotations for the month ending Saturday, December 17th, as supplied to the Review by **Robert Meredith & Co., 57 St. Francois Xavier Street, Montreal:—**

Par value of shares.		Asked.	Bid.
.10	Canadian Gold Fields Syndicate.....	.07	.06
5.00	Cariboo Hydraulic	.75	—
1.00	Centre Star	.23½	.20
1.00	Deer Trail Consolidated	.02	—
1.00	Giant	.03½	.01
10.00	Granby Consolidated	5.25	5.12
10.00	Montreal and Boston	1.25	1.12
1.00	North Star	.02	—
1.00	Payne	.04	.02
1.00	Rambler Cariboo	.17	.16
1.00	Republic	.03½	—
1.00	St. Eugene	.47½	.45
1.00	War Eagle	.10½	.09
1.00	White Bear	.04¾	.04¼
100.00	Nova Scotia Steel (common).....	.68½	.68⅜
100.00	Ditto ditto (preferred).....	—	1.05
100.00	Dominion Coal (common).....	.64	.63
100.00	Ditto ditto (preferred.....	1.18¾	1.17
100.00	Dominion Iron and Steel (common)...	.18¾	.18½
100.00	Ditto ditto ditto (preferred)..	.59	.58¾
——	Ditto ditto ditto (bonds).....	.84½	84¼

PERSONALS.

Mr. R. C. Barkley, who has been for many years associated with the Massey Mining Co., at Massey, Ont., has gone to Florida for the winter.

Mr. Paradie, of the Public Works Department, Ottawa, was in Alberta last month, where he investigated the possibility and cost of constructing a waggon road over the rock slide at Frank. The Government have been asked to make a public road there.

Mr. Harvey Graham, a director of the Nova Scotia Steel and Coal Co., was in Montreal recently, and expressed the opinion that the present year's output of 400,000 tons of coal by this company will be exceeded in 1905. Mr. Graham is of the opinion that industrial matters will suffer no check during 1905.

Mr. Jacob Langloth, president of the American Metal Co., of New York City, has been chosen president of the Granby Consolidated Mining and Smelting Co., Ltd., in succession to Mr. S. H. C. Miner, of Montreal, resigned. Mr. Langloth is a copper magnate of long standing and immense resources in capital.

Mr. E. B. Kirby, general manager of the Centre Star and War Eagle mines at Rossland, has resigned, to take effect on the 15th of January. It is understood that Mr. Kirby will resume the private practice in the United States, from which he came in 1899 to the management of the above companies. Mr. Kirby's departure will be felt, as he has distinctly advanced the practice since he has been in Rossland.

INDUSTRIAL NOTES.

The Canadian Westinghouse Co., Ltd., are issuing in individual pamphlet form concise descriptions of the various machines which they manufacture; amongst these, the latest one is devoted to Voltmeters and Ammeters.

The Westinghouse Electric & Manufacturing Company has been awarded the contract for all the electric apparatus to be installed at the El Oro Mining and Railway Company, El Oro, Mexico. This contract amounts to nearly $100,000.00.

The Jeffrey Manufacturing Company is to be congratulated upon the typography, paper and illustrations of the new series of catalogues which it is now issuing. Especially is this the case with the catalogue of pulverizing machinery, in which is shown in numerous illustrations the Schoellhorn-Albrecht Pulverizer noted in our last issue. As a pulverizer for fluxes, coal and clay rocks it has no equal.

Messrs. McAvity & Sons are filling an order from the Dominion Government for fifty metal posts, of a certain composition, to be used as boundary monuments on the line between the United States and Canada. The posts are of brass, five feet in length, and of rectangular section; on one side the word "Canada," and on the opposite side the words, "United States," are cast in the metal. The posts are hollow, with sides one inch in thickness.

The A. Leschen & Sons Rope Co., of St. Louis, Mo., have made a new form of yoke rope clip, which is superior in its holding powers to other forms now on the market. Corrugations are cast on the hand piece which assist the grip of the rope, due to compressions. For smoke stack and derrick guys, this device will be found most satisfactory. This firm was awarded three Grand Prizes at the St. Louis World's Fair: One for Wire Rope, one for Wire Rope Tramways, and one for Conveying and Transmission Outfits.

The B. Greening Wire Co., the oldest and best known wire house in Canada, have just issued a new catalogue of wire cloths, wire screenings, and perforated sheet metals, which they manufacture. The pamphlet shows the accuracy with which mesh spaces are made, and will be of great value to users of screening material. The catalogue is one of the most complete in its line that has been published, and the tables show an innovation, in that they give the decimal size of the mesh opening as well as the decimal size of the wire.

The Canadian Westinghouse Company, Limited, has sold to the Hamilton Cataract, Power, Light & Traction Company, for use in its Victoria sub-station at Hamilton, Ontario, two motor-generator sets, each consisting of a synchronous motor and a direct current generator. The motor-generator sets will be of the two-bearing type, the generators delivering direct current at 550 volts to the railway system, and each being rated at 750 k.w. The synchronous motors will take two-phase current at 8,000 alternations and 2,400 volts, and will be rated at 1,380 h.p. The excess of capacity in the motors is provided so that they may be used for raising the power factor of the transmission system. Power is taken through lowering transformers from the high-tension transmission line from the De Cew Falls station of the company.

A feature of the developments in the Baltimore Electric Power Enterprise is the exclusive adoption of steam turbines as prime movers. A contract recently closed with the Westinghouse Machine Company provides an equipment of 4,000 k.w., in two generating units of 2,000 k.w. each. A Westinghouse electrical equipment has also been contracted for. The steam turbine plant will operate with a boiler pressure of 175 lbs., and a superheat of about 100 degrees Fahr. The plant has been designed on the separate unit plan, which consists of a number of distinct power plants placed side by side, each entirely separate from the other, but each capable of helping out the other in case any link in the system should be disabled. In addition to the precaution against interruption of service which is thus insured, there will be installed a large storage battery which will ordinarily "float" on the system.

The work of extending the Chicago Drainage Canal, in connection with the development of power therefrom, which has been mentioned from time to time in the engineering press, is now well in progress. The plans provide for the extension of the channel now in use for a distance of over 10,000 feet southerly to the site selected for the power house, and also provide for the excavation of a tail-race 6,800 feet long, from this point to the junction with another section of the canal. The extension will be constructed with concrete walls, and an earth and rock embankment. The tail-race is to be 160 feet wide and deep enough to give a minimum depth of twenty-two feet of water; the mean head of this power development will be thirty-two feet, and the net horse power obtained on a flowage of 600,000 feet per minute will be 27,000 h.p., figured on an efficiency of seventy-five per cent. for the turbines. The power units of the plant are designed to pass 100,000 cubic feet at 8-10 of the full discharge. They consist of turbines on horizontal axes of a nominal generating capacity of 6,500 h.p. under a 34-foot head, and at 150 r.p.m. Each power unit is to drive one 3,750 kilowatt 3-phase 2,200 volt generator. At the present time large use is made of compressed air machinery, of which that manufactured by the Rand Drill Co. seems to be the favorite. At present there are thirty-two No. 3¼ Little Giant Rand drills, four channellers and a number of pumps all operated by compressed air. The plant includes two Rand Imperial type ten drill compressors, each having a capacity of about 2,000 cubic feet of free air per minute, which is delivered through a system of piping which aggregates ten miles in length. The average depth of the holes drilled is fourteen feet, and the average performance of each drill, per shift of ten hours, is 125 feet. The machines of the Rand Drill Co. have had important and successful competitions with other makes of drills in various parts of the world; they recently came off victorious in the South African contest, and their selection for the work of this extension is another evidence of the satisfaction they give to contractors and engineers.

MINING NOTES.

NOVA SCOTIA.

The Cape Breton Coal, Iron and Railway Co. is considering new plans for the equipment of its properties, and for the extension of work.

The last coal steamer from Nova Scotia for Montreal left Port Morien on December 1st. The steamer followed the ice-breaker up the St. Lawrence.

During the year 1904 there were imported by the Dominion Iron and Steel Co. 68,663 tons of iron from foreign countries: Spain shipped 25,050 tons, Sweden 24,650 tons, and the Lake Superior region in the United States 18,963 tons.

The Mining Society of Nova Scotia, at its last meeting held November 16th, endorsed the action of the Board of Trade in forming a mining company to investigate the mineral resources of Nova Scotia, and pledged its aid to the movement.

The end wall of the coal-washing plant of the Dominion Iron & Steel Company has crumbled and fallen. Lack of proper anchorage is given as the cause. The accident did not interfere with the operation of the plant.

The Cape Breton Coal & Iron Company have completed the survey of a railway line from the colliery at Broughton to the shore of Sydney Harbor, a distance of fifteen miles. The company proposes to erect a shipping pier at the terminus of the railway.

The shipments of coal made by the Dominion Coal Company, Limited, in November were 215,746 tons. This is 61,318 tons less than the output for October. Now that the St. Lawrence trade for the season is over, the outputs will show a considerable decrease, although shipments from Louisburg are fairly brisk.

The Nova Scotia Steel Company, at Belle Island, Newfoundland, will put out 100,000 tons of ore for Sydney alone this season, besides the quantity they have sent to Rotterdam and other points. Up to date they have landed at Cape Breton 80,000 tons, and three steamers with a carrying capacity of 5,000 tons will take the balance before work closes for the year.

The Mining Committee of the Halifax Board of Trade have begun with energy by making a request to the Dominion Government for the services of an expert to investigate the iron ore resources of the province.

The information is asked for in order that the Board of Trade may both protect and encourage investors.

A new seam of coal on the Cossitt areas has been discovered about two and a half miles from Sydney, on the Mira road. A drill test showed a thickness of from six to seven feet; and the slope, which is now down about fifty feet, shows a seam about twenty-four inches thick. The Cossitt areas are contained in a lease which comprises some twenty-five square miles.

The coal-washing plant of the Dominion Iron and Steel Company has occasioned a considerable economy in the working of the furnaces, and has produced a considerable improvement in the quality of the pig iron turned out, as well as somewhat increasing the yield. The steel rods which have been turned out from the new rod mill are giving great satisfaction to customers, and the demand for them is causing the management to contemplate operating the mill on a double shift.

The Nova Scotia Steel and Coal Co. have issued during the month a prospectus for the sale of twenty-five year, six per cent. gold bonds. In this document are some interesting statements. The coal output of the company has increased from 237,000 tons in 1901 to 550,000 tons in 1904. Estimates of the quantity of coal contained in the Point Aconi

and Sydney areas have been put at 155,000,000 tons, but the discovery of the fact that the old Sydney main seam extends across the full width of the Point Aconi areas increases this total quantity to 195,000,000 tons.

The output from the Dominion Coal Company's mines for the month of November was 232,720 tons, distributed as follows:—

Dominion, No. 1	43,551 tons
Dominion, No. 2	49,325
Dominion, No. 3	22,484
Caledonia	44,856
Reserve	44,344
Hub	9,505
International	18,655
	232,720 tons

ONTARIO.

The plant of the Imperial Steel and Wire Company was put into commission on the 7th day of December; its daily capacity is supposed to be fifty tons.

At the Redeemer mine, near Dryden, some good ore has been found in the 100 and 200 feet levels, close to the shaft, and has been sent to the stamp mill. This mine is chiefly owned by Chicago parties.

The stamp mill of the Redeemer mine, near Dryden, was started late in the month of November. It contains two batteries of five stamps each; the stamps weigh 700 lbs., and the plates are of soft copper and amalgamated with mercury.

Operations at the new plant of the Canadian Copper Co. are going smoothly. The change from the old methods to the newer ones has taken place gradually, and work around the new smelter is now as much a matter of routine as was the work at the old plant.

The Ideal Gold Mining Co., of Detroit, announces that the negotiations for the transfer of its property to capitalists have been abandoned, but new arrangements have been made with Detroit people to obtain the money necessary for the resumption of active mining operations.

The 20,000 tons of 80-lb. steel rails ordered by the Government from the Lake Superior Corporation have all been made and passed inspection; some 14,000 tons have already been delivered to the Intercolonial Railway at Montreal.

The work at High Falls on the foundation of the new electric plant is practically completed. The foundations of the power house are finished, the main coffer dam is completed, and the smaller dams are also finished. A great part of the work can now be carried on during the winter.

The Ontario Bureau of Mines is forwarding a collection of corundum and corundum-bearing rocks to the National Museum at Paris, for permanent exhibition there. The collection has been made from properties in Ragland, Carleton, and Methuen townships, and includes many handsome specimens.

Mr. D. D. Mann, of the Canadian Northern Railway, and Mr. James Hunter, a western mine promoter, arrived at Winnipeg this month to discuss negotiations relating to the development of the Atikokan iron range. If negotiations are satisfactorily concluded, a blast furnace will be located at Port Arthur.

The receipts of coal at Toronto for November were 4,000 tons in excess of the receipts for the same month in 1903; the figures are 11,366 tons, as against 7,074 tons for November 1903. The total receipts at the port of Toronto for the last season were 171,787 tons. This year, the receipts to 1st of December have been 171,405 tons.

Some fine specimens of rich ore from the Paymaster mine have been shipped to the offices of the Northern Development Co., at Detroit, for exhibition. The Paymaster is located in the Manitou district, and shows a very good prospect near the surface. So far, the Manitou gold fields seem to be among the most promising in the Western Ontario country.

The International Nickel Co. made a splendid exhibit at the St. Louis Exposition. Each step in the process of the extraction of the metal from the ore was shown, beginning from the ore and finishing with ingots of copper and small cubes of nickel. The exhibit also contained displays of the manufacture of nickel, including nickel sheets, nickel wire, and kitchenware made from nickel.

Winnipeg despatches would have us believe that wise citizens of that town are going to invest $200,000 in the manufacture of peat fuel from the bogs near Fort Frances, in the Rainy River country. The Lieut.-Governor of Manitoba and Mr. Wm. Whyte are among the names mentioned as those of parties interested. It will be remembered that no peat venture in Canada has yet been anything but a commercial failure.

The International Nickel Co. have been among the first to avail themselves of the new roofing material, made in Montreal, and known as Asbestos Lumber. This lumber is made of fibres of asbestos compressed into sheets under great pressure. Its advantages lie in the fact that it is fire and acid proof, and hence makes a more permanent roofing material than the iron plates which have previously been in use for the furnaces.

The Kakabeka Falls, on the Kaministiquia River, near Fort William, have been purchased by a syndicate of Montreal people, of whom Mr. Chas. R. Hosmer, Mr. H. M. Holt, and Mr. F. W. Thompson are the principal members. The intention of the syndicate is to develop power to be used and sold in Fort William and vicinity. The manufacturing interests in Fort William are numerous enough to justify the installation of a large electric power plant, and it is understood that active work upon the water power plant will be commenced very shortly.

Reports from the Rainy River district say that it is building up rapidly along the line of the new Canadian Northern Railway, between Fort William and the International boundary line. There is very general activity, saw mills have been erected in many places, arable land has been taken up by the farmers, and new towns are springing up at proper intervals. One million acres of land have been taken up during the last three years, and three-fourths of this large amount is occupied by settlers who have a very respectable percentage of it in cultivation. The town of Rainy River now has a population of 2,000 people. The development of the International Falls as a water power for the generation of electricity is going forward very rapidly.

A large deposit of iron ore, on the shores of Lake Winnipeg, twelve miles from the Canadian Pacific Railway, has been taken up by some capitalists from St. Paul, Chicago, and Winnipeg, who propose to develop the property and construct smelting works in the vicinity. The property is believed to be the same one that has been in the hands of Mr. Proudfoot for some years; the quality is hematite, but there is a considerable amount of both phosphorous and sulphur in the ore, and the hopes of the projectors as to the profitable result from the enterprise are not endorsed by others who are more familiar with the property. That a large deposit of good quality of iron in the centre of Canada would be most desirable is unquestionable, but there is much work yet to be done before any assurance to that effect can be given to the public.

Sudbury has been somewhat excited over the publication in "Hardware and Metals" of an article by Joseph Wharton, of Philadelphia, which particularizes the presence of rare metals in the ores of the Sudbury district. Mr. Wharton has stated that the 300,000 tons of copper-nickel ore which has been treated contained 3,000 ounces of palladium, the market value of which is reported as $400 an ounce. We do not think that mine owners need be excited by this article, as the cost of recovering the rare metals which occur in infinitesimal quantities in the Sudbury mines, would preclude any extensive mercantile business being transacted in them. People in Ontario should take warning from the furore for cobalt ores which occurred early last spring in connection with the discovery of large deposits of that ore near Haileybury. More cobalt has been taken out of the mines near Haileybury than there is a market for, and it must always be remembered when speaking of the rarer, and consequently more valuable, metallic elements, that the market for them is so extremely limited that no considerable business therein can be built up.

NORTH-WEST TERRITORIES.

The company operating at Edmonton report that they have struck a good supply of natural gas.

The Alberta Telephone Co. is to install a complete telephone system throughout the Crow's Nest Pass district which lies east of the summit.

Advices from interested people tell the Review that the zinc furnace to be erected will be located at Frank, Alberta, instead of at Fernie, B.C. It appears that many of the shareholders in the West Canadian Collieries are also interested in the zinc smelter, and hence the coke and coal used is to be supplied by the Lille collieries, and not by the Crow's Nest Pass Coal Co.

The West Canadian Collieries Company, operating coal mines at Bellevue and Lille, Alberta, have fifty coke ovens of the Solvay type at Lille. These ovens are charged and drawn by machinery, and make about four tons each of first-class coke every twenty-four hours. The coke is sold to the British Columbia smelters.

The Lille collieries are situated on a branch line connecting with the C. P. R. at Frank; the Bellevue collieries are on the main line of the C. P. R., one and a half miles east of Frank station.

At both Lille and Bellevue are prosperous small towns, which depend on the mines for subsistence. The company also owns coal properties at Blairmore and Byron Creek, which, at present, are not operated.

BRITISH COLUMBIA.

The coal deposits of the Quilchenna district are being exploited amongst Ottawa investors by R. G. Macpherson, M.P., and others.

The Providence vein has been exposed by stripping for a distance of more than 500 feet, and in places it measures eight feet in width.

At the once famous Rambler-Cariboo mine, in the Slocan, work is now confined to the driving of the cross-cut tunnel,which has now attained a length of a little over 1,300 feet.

The ore shipments from Rossland to the 1st of December, a period of eleven months, totalled 318,000 tons ; those from the Boundary district from the same period totalled about 733,000 tons.

The Le Roi mine, under date of December 12th, advises that development of the ore shoot on the 1,450 ft. level has produced ore assaying $20 in gold and $5 in copper; the extent of the ore shoot is not yet known.

Mr. Oscar Fernau, the promoter of the Kootenay Zinc Concentrating Company, has optioned several claims on Kootenay Lake. On one of these there is a ledge of solid sphalerite twenty-four inches in width, which assays forty per cent. of zinc and ninety-five ounces of silver.

The Inland Sentinel reports the discovery of a four-foot seam of bituminous coal on the branch line between Sicamous and Okanagan Landing, between Enderby and Mara.

Ore from the dumps of the Brooklyn and Stemwinder mines is being shipped to the Trail smelter. In the neighborhood of 120 men are now employed at these mines and at the Rawhide.

The Fraser River at Lillooet is reported to be at a lower stage than has been known for twenty years. It is anticipated that by February some very rich bars which have been submerged since 1883 will be again uncovered, and that large amounts of gold will be recovered from them.

The Grant mine, on the north fork of Woodbury Creek has been bonded to Eastern people, who will work it during the winter. The last ore shipments were of very high grade, running sixteen per cent of lead and from 435 to 455 ounces of silver to the ton.

The Cousins claim, on Ten Mile Creek, in the Similkameen is reported to carry large percentages of native copper. Specimens taken from the shaft at a depth of twenty-five feet gave forty per cent. of metallic copper in slugs and wires.

Dividends from British Columbia mines in 1904 have not been numerous, but there have been some which were very satisfactory. The St. Eugene paid $64,000, the Tyee $43,200, the Le Roi No. 2 $57,600, and the Cariboo (Camp McKinney) $50,000, the Providence $20,000, and the Crow's Nest Pass Coal Co. $172,254; a total of $407,324 of which record has been made.

The mines about Silverton, B. C., have been active during the summer, by reason of the bounty on lead granted by the Government. The Hewitt has shipped 400 tons, netting $30,000; the Wakefield has shipped over 1,000 tons, averaging sixty-five per cent. of lead and fifty ounces of silver; the Fisher Maiden has shipped about 500 tons of dry ore, which was of high grade.

The Last Chance mine, near Greenwood, expects to make shipments this month. The cross cut towards the footwall of the deposit has disclosed two streaks of good ore, one eight inches wide, the other two feet in width, on which levels are now running. The amount of low grade ore already opened is so large that the management is considering the erection of concentration works.

The Jacko Lake country, near Kamloops, has been prospected during the past summer in a thorough manner, and the results obtained promise a brilliant future for the camp. On the Monte Carlo claims, values of twenty-two per cent. copper with $12 in gold have been obtained, and in the Ajax group total values in excess of $50 are reported. The widths of these bodies is reported as seven feet on the Monte Christo, and as thirty feet on the Ajax. If such results can be averaged, there should be a permanent camp at Jacko.

The Granby Consolidated M. & S. Co. is using electricity for motive power wherever it is possible to do so. An electric locomotive, equipped with two 35 h.p. motors, has been ordered from the Westinghouse Co., and will be used in No. 3 tunnel to haul cars to the new ore crusher and ore bins. The ore crusher was manufactured by the Jenckes Machine Co., of Sherbrooke, Que., and has a jaw opening of 36 by 42 inches. It also will be operated by an electric motor.

The survey members of the Canadian portion of the International Boundary Demarcation Commission have returned to Ottawa with Mr. J. J. McArthur who was in charge of the party. The portion assigned to this party ran from Port Hill, Idaho, on the Kootenay River, to Cascade, in the Boundary district; the section between Cascade and Mirway, and that from the Kootenay River to the summit of the Rockies constituted the task of the United States party. There still remain the sections from the Similkameen to the Skagil, and from the Skagil to the coast for next year's work.

The British Columbia Mining Exchange and Investor's Guide for November gives an interesting description of some features of the Skeena mining division at the head of the Portland Canal. Comparatively little work has been done in this district, as white men have only been familiar with it for about four or five years. According to the article mentioned, values seem to be chiefly in silver and copper with but little gold; the grade, however, appears to be high. One feature we note is the discovery of a deposit of molybdenite, which returned thirteen per cent. of metallic molybdenum. There would appear to be numerous deposits of galena ore, with occasional pockets of dry silver sulphides, and not infrequent occurrences of large bodies of copper gold sulphurets. The climate is reported to be comparatively mild, and the season to be one of unusual length for so high a latitude.

The London British-Canadian Review prints the following:—"The shutting down of the Payne mine appears to have been adopted in anticipation of successfully demonstrating the existence of a rich vein in the lowest, or No. 8, tunnel. A lost vein was found in the lower workings a year and a half ago, and the mine has been thoroughly overhauled and re-equipped with the most modern machinery, specially adapted for once more placing the property at the head of the dividend-payers in British Columbia. A great deal of development has been done of late, and this, added to the amounts paid out for new plant, necessitated a re-arrangement of the company's finances. The directors offered $90,000 of debentures upon favorable conditions, but only a portion of the required amount was taken up by the shareholders, and in consequence some new arrangement will have to be made before work can be resumed. From all appearances, the Payne mine is in a better condition to-day than it has been since dividends ceased, and it is not improbable that the directors will be able to make satisfactory arrangements for the early resumption of work again."

We fancy the president of the Payne Mining Co., Lieut.-Col. Henshaw, will be delighted to learn this news from London, and that the directors will at once go down in their pockets for this $90,000, which they have been steadfastly refusing to do since March last.

YUKON.

Bunty Creek, and its tributary, Forlorn Hope, have been added to the list of creeks showing recent discoveries. The gravel is at least twenty feet in depth, but no hole has yet reached bedrock.

Operations on Clear Creek this winter will be few, as experience has shown that the bulk of the ground is too shallow. Lack of depth to the gravel makes it better suitable for summer than winter operations.

Winter work is reported to be well under way on Paradise Hill, Hunker Creek, and advices state that there are many more men at work, from forty to eighty, on Hunker this year than last year.

A strike of gold in a new channel is reported on 245, below Discovery, on lower Dominion Creek. The gravel is reported to run about $2.50 to the bucket, or nearly $1.00 per cubic foot. Arthur Le Fleur and partners own the claim.

The application of Tyrrell and Cameron for a right to sell water from Sourdough and Cripple Creeks, tributaries of Bonanza Creek, has been protested by the Bonanza Hydraulic Company, before the Gold Commissioner's court.

The Duncan Creek country, on the Upper Stewart River, will have little work done this winter through the failure of the steamer "Prospector" to reach the upper river. The "Prospector" had supplies aboard, but was unable to get up owing to low water.

Reports from the Tanana district show a great shortage of provisions, which will prevent development this winter. It is also reported that there is a large surplus of men in the camp, not one out of three being able to find employment.

So many applications for water to be taken from Australia Creek and its tributaries have been filed with the mining recorder that the flow of the stream is not one-third large enough to satisfy all of them. These applications have been made in consequence of a furore to hydraulic ground on Sulphur and Dominion Creeks.

From January 1st to October 31st the comptroller of the Yukon Territory has received royalties amounting to $230,263.90 on $9,210,556.10 output. The gold, for purposes of royalty, is valued at $15.00 per ounce, but its average assay value is a trifle over $16.00; the above output, therefore, would be more correctly valued at about $10,000,000.00. There yet remains with the banks and with the larger companies an accumulation which will probably increase these figures to nearly $12.000,000.00.

COAL NOTES

The Joggins mines are now putting out 250 tons of coal daily.

The Gowrie and Blockhouse mines are yielding 300 tons of coal a day.

Dominion No. 1 colliery is now putting out from 2,000 to 2,300 tons per day.

No. 1 Allan shaft, of the Acadia Coal Co., had reached a depth of 450 feet, and No. 2 shaft a depth of 480 feet on the 1st of December.

The Port Hood collieries have made a daily production of 500 tons of coal this year; next year they expect to make a daily record of 750 tons.

The shipment of 5,000 tons of coal to Mexico, made in October by the Dominion Coal Company, was so successful that a contract for 25,000 tons has resulted.

The water shipments of coal by the Dominion Coal Co. in 1904 were 270,054 tons in excess of any previous year.

The C. P. R. coal handling plant at Fort William has unloaded 500,000 tons this season from boats; that of the Canadian Northern Railway at Port Arthur has handled over 200,000 tons.

The Dominion Coal Co. having succeeded in creating a small market for Cape Breton coal in Mexico, are now sending a trial shipment of 3,000 tons to South Africa. The S.S. Melville cleared from Sydney, C.B., for Cape Town and New London, South Africa, November 30th, with this shipment on board, and strong efforts will be made to establish a South African market. If successful in these endeavors to secure a foreign market, the company will be able to maintain operations on a continuous scale throughout the winter seasons. At present, each first of December occasions the reduction of the working force and general curtailment of all operations.

The total tonnage of coal brought by the St. Lawrence route to river ports during the season of 1904 was 1,454,365 tons, or over 200,000 tons more than any previous year. In this large total, the Dominion Coal Co. is easily the first, with the Nova Scotia Steel & Coal Co. second. The imports of Scotch and English coal fell off to less than forty per cent. of last year's tonnage, and the shipments of the Intercolonial Coal Company show a decrease of about 5,000 tons. From a table compiled by F. A. Routh & Sons, coal agents, the receipts have been as follows:—

	1904. Tons.	1903. Tons.
Dominion Coal Co.	1,116,191	846,137
Nova Scotia Steel & Coal Co.	170,319	159,618
Newcastle Syndicate	14,305	12,815
Port Hood Coal Co.	4,634	21,374
Intercolonial Coal Co.	39,349	44,248
Inverness Coal Co.	43,441	17,784
Acadia Coal Co.	15,134	4,277
Scotch and English Coal	47,961	134,339
United States Coal	3,031	2,748
	1,454,365	1,243,340

The Dominion Coal Company asked its employees, on the 28th of November, to enter into an agreement or contract with it for the term of three years at the present rate of wages, urging as its reason for so doing that security from danger of labor troubles would enable the company to enter into long contracts, and would place the business in a more stable condition. The company also claimed that such an agreement and security from strikes would attract a better class of labor, and produce a better quality of coal; formerly the percentage of slack coal was thirty-three, now it had increased to seventy-six per cent. The miners took the matter back to the lodges of the P. W. A. for discussion and consideration, and again met Vice-President Wanklyn and Manager Duggan on the 2nd of December, when some five hours' discussion took place. The number of men at present on the pay roll is much greater than it was two years ago, and the allotment of rooms to the cutters is less than one-half what it used to be; the crowding consequent to this condition prevents the output per man from reaching former figures, and in the opinion of the miners is the cause of the increased cost of production.

The miners are not unanimous as to the three years' contract; the machine runners, shot firers and other high wage men are inclined to accept, but the loaders, drivers and lower paid men object to binding themselves to the present low rate of wages.

No decision was reached, and further conference is to take place.

In the season just closed, the Dominion Coal Co. moved an average of 5,580 tons per day up the St. Lawrence River. These figures are the record on this side of the water (so far as we have been able to learn) for fuel moved by sea by one compan"

PROVINCE OF NOVA SCOTIA.

Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin

—AND—

PRECIOUS STONES.

TITLES GIVEN DIRECT FROM THE CROWN, ROYALTIES AND RENTALS MODERATE.

GOLD AND SILVER.

Under the provisions of Chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills, who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted Gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licences to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly, either by arrangement with the owner or by arbitration, all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are : Copper, four cents on every unit ; Lead, two cents upon every unit ; Iron, five cents on every ton ; Tin and Precious Stones, five per cent. ; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. A. DRYSDALE,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

PROVINCE OF QUEBEC

The attention of Miners and Capitalists in the United States and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago, Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are $5 and $10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles and the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, $2 and $4 according to distance from railway

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mining of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals, and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than $500 if mining for the superior metals ; and not less than $200 if for inferior metals. In default, cancellation of sale of mining lands

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, $2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in surveyed territory, $5 for every 100 acres, and (2) in unsurveyed territory, $5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds: Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of $5 and an annual rental of $1 per acre. Each license is granted for 200 acres or less, but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties, unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,

PARLIAMENT BUILDINGS, QUEBEC, P

Dominion of Canada.

SYNOPSIS OF REGULATIONS

For disposal of Minerals on Dominion Lands in Manitoba, the North-west Territories and the Yukon Territory.

COAL.

Coal lands may be purchased at $10 per acre for soft coal and $20 for anthracite Not more than 320 acres can be acquired by one individual or company Royalty at the rate of ten cents per ton of 2,000 pounds shall be collected on the gross output

QUARTZ.

Persons of eighteen years and over and joint stock companies holding free miner's certificates may obtain entry for a mining location

A free miner's certificate is granted for one or more years, not exceeding five, upon payment in advance of $7.50 per annum for an individual, and from $50 to $100 per annum for a company, according to capital

A free miner, having discovered mineral in place, may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within 15 days if located within ten miles of a mining recorder's office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is $5.

At least $100 must be expended on the claim each year or paid to the mining recorder in lieu thereof. When $500 has been expended or paid the locator may, upon having a survey made, and upon complying with other requirements, purchase the land at $1.00 an acre.

Permisson may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper, in the Yukon Territory of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of a Royalty of 2½ per cent. of the sales of the products of the location

PLACER MINING

Manitoba and the N. W. T., excepting the Yukon Territory.—Placer mining claims generally are 100 feet square; entry fee $5, renewable yearly On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark The latter includes bar diggings, but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

Dredging in the rivers of Manitoba and the N. W. T., excepting the Yukon Territory.—A free miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental, $10 per annum for each mile of river leased. Royalty at the rate of two and a half per cent collected on the output after it exceeds $10,000.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed or bars in the river below low water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date Rental $100 per mile for first year and $10 per mile for each subsequent year Royalty, same as placer mining.

PLACER MINING IN THE YUKON TERRITORY.

Creek, gulch, river and hill claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other placer claims shall be 250 feet square

Claims are marked by two legal posts, one at each end, bearing notices. Entry must be made within ten days, if the claim is within ten miles of mining recorder's office One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim must hold a free miner's certificate.

The discoverer of a new mine is entitled to a claim of 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee, $10 Royalty at the rate of two and one-half per cent. on the value of the gold shipped from the Yukon Territory to be paid to the Comptroller

No free miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and free miners may work their claims in partnership by filing notice and paying fee of $2 A claim may be abandoned, and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least $200

A certificate that work has been done must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a free miner

The boundaries of a claim may be defined absolutely by having a survey made and publishing notices in the Yukon Official Gazette.

PETROLEUM

All unappropriated Dominion Lands in Manitoba, the North-west Territories and within the Yukon Territory are open to prospecting for petroleum, and the Minister may reserve for an individual or company having machinery on the land to be prospected, an area of 640 acres. Should the prospector discover oil in paying quantities, and satisfactorily establish such discovery, an area not exceeding 640 acres, including the oil well and such other land as may be determined, will be sold to the discoverer at the rate of $1.00 an acre subject to royalty at such rate as may be specified by order-in-council.

Department of the Interior

OTTAWA, February, 1904

JAMES A. SMART,

Deputy of the Minister of the Interior.

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